LECTURES ON THE RESULTS OF THE EXHIBITION,

DELIVERED BEFORE

THE SOCIETY OF ARTS, MANUFACTURES, AND COMMERCE,
AT THE SUGGESTION OF H. R. H. PRINCE ALBERT,
PRESIDENT OF THE SOCIETY.

LECTURE XII.

BY

Capt. Washington,

R. N.

SHIPPING, PARTICULARLY LIFE-BOATS.

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LECTURE XII.

ON THE PROGRESS OF NAVAL ARCHITECTURE, AS INDICATING THE NECESSITY FOR SCIENTIFIC EDUCATION, AND FOR THE CLASSIFICATION OF SHIPS AND OF STEAM-ENGINES: ALSO, ON LIFE-BOATS.

BY

CAPTAIN WASHINGTON, R.N. F.R.S.

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ON

THE PROGRESS OF NAVAL ARCHITECTURE, AND ON LIFE-BOATS.

The progress of Naval Architecture, as illustrated by the models of boats and shipping collected together in the Great Exhibition—in that vast building, along the avenues and galleries of which we all lately wandered day by day, dazzled with the treasures and wonders of art—forms an interesting and instructive study. Who could fail to be struck by the contrast presented by the ancient Celtic boat, the *curragh,* still in use for fishing on the north-west coast of Ireland, or the equally primitive *coracle* daily used for salmon-fishing in the rivers of Wales, as compared with the magnificent specimen of the *Queen,* one of the largest and most beautiful ships of the British navy, which, in the centre of the north transept, arrested the eye of the observer, as soon as the gorgeous and overpowering *coup*

d'œil that burst on us all at entering, gave leisure to reflect.

Amidst the sparkling of the crystal fountain, backed by a forest of tropical plants, and with the rich hangings of Persia and India on either hand, there sate the *Queen* of the ocean, simple, severe, yet beautiful in form, a type of the progress of art as applied to ship-building during the last eighteen centuries. The transition from the inconvenient and unsightly forms of antiquity to the graceful outline and imposing contour of a first-class ship-of-war, is no less remarkable as an indication of progress in this science, than instructive as practical evidence of the consistency of beauty of form with those qualities of speed, strength, stowage, and stability, which are essential in such structures.

The Exhibition of 1851, although rich in beautiful models showing the present state of naval architecture, afforded only in a small degree the opportunity of tracing the successive steps in the history of ship-building. It is true that there might be seen the primitive British *coracle* of wickerwork covered with hide, carrying us back in imagination to the time of our forefathers, and its contemporary, a Roman war-galley; but from that period we jump over some centuries until we arrive at the model of the *Henri Grace à Dieu,* of 1200 tons, built at Erith about the year 1513.

We would gladly, however, have seen the connecting links in the chain; as the model of the vessels in which the enterprising Scandinavian Sea-kings performed their

almost incredible voyages out of sight of land, without the aid of compass or of chart, and with only the sun and stars, and flight of birds, to guide them; and of the Mediterranean galley pulling from forty to sixty oars on each side, which our great King Alfred introduced to resist the ravages of the Danish marauders. We have no record either of the form or probable size of ships at the period of the Norman Conquest, unless it be the picturesque representations of Froissart, or the more grotesque specimens of the Bayeux tapestry. Nor of the introduction of sailing vessels, although the ancient chronicles tell us that when Prince William, son to Henry I., was drowned in crossing from France to England, three hundred persons perished with him, implying considerable burthen in the vessel. We learn, too, that a little later the commercial intercourse between France and England, in wines, wool, and woollen cloths, was extensive, which could not have been carried on profitably except in sailing vessels. The expedition of Richard Cœur de Lion, in 1190, to join the crusade to the Holy Land, consisted of nine "tall shippes," besides one hundred and fifty others of smaller size, and galleys. But it was in the beginning of the fourteenth century that the invention of the mariner's compass, by Gioja of Amalfi, gave the great impulse to ship-building, by enabling vessels to make long voyages in comparative safety. A century later the burthen of the largest ships appears not to have exceeded six hundred tons,—yet, at this time, the mercantile shipping of England must have been considerable, for, about the middle of the century flourished the celebrated merchant, William Conynge, of

Bristol,—the builder of the beautiful church of St. Mary Redcliff, in that city,—who, among other vessels, owned the *Mary and John*, a ship of 900 tons.

The next step in advance was the building the *Great Harry*, about the year 1488, in the time of Henry VII., which well deserved the record of a model as the parent of the British navy. It was high time that this island, if she wished to take any place among maritime nations, should be up and doing, for other countries were fast increasing the size of their ships, and pursuing the path of discovery, which was the first step towards that intercourse which has resulted in bringing to our shores—and to the Great Exhibition—the silver and gold, the cotton, the coffee and sugar of the West, with the pearls, the ivory, and silk of the East. For it was only a few years later that Spain, in 1492, fitted out the ever memorable fleet—small as it was and of crazy ships—that enabled Columbus to prove to incredulous Europe the existence of a new world, and that Portugal equipped the expedition in which Vasco de Gama, in 1497, rounded the Cape of Good Hope, and laid open the route to the East; to be followed within half a century by the zealous Padre Francisco Xavier, the "Great Apostle of the Indies," who, in return for the myrrh, and the spices, and the frankincense of the East, first imparted to the natives of India the more precious gift of the Gospel of Christ.

The *Henri Grace à Dieu*, before mentioned, comes next on the list. This model, now lying on the table before us, and for which we are indebted to the liberality of the Ad-

miralty, shows two tiers of port-holes; but the lower battery so little raised out of the water, that it is doubtful if she could have sailed with safety on a wind; and we know by the loss of the *Marie Rose* at Portsmouth, a little later in this reign, that, owing to her ports being within sixteen inches of the water, in going about she upset and sunk, when six hundred persons perished. At so comparatively low a state was nautical skill in this country, that fifty Venetian sailors were hired to try and raise this wreck; their attempts, however, all failed, as the wreck of the *Marie Rose* remains, to this day, at Spithead; and so lately as August 1836, several of her brass cannon, of exquisite workmanship, were recovered from the bottom of the sea by the skill of the late William Deane (well known by his successful submarine operations by means of the diving-helmet), and are now lying in the Repository grounds at Woolwich.

The spirit of enterprise that prevailed during the reign of Elizabeth could not fail to have some influence on our ships, and the indefatigable and politic Raleigh directed his attention to the improvement of our navy. Sir Robert Dudley, afterwards Duke of Northumberland, a man of enlarged views and comprehensive mind, paid also much attention to naval affairs. He purposed to lower the forecastles and sterns of ships, and to abridge their then cumbrous ornaments; to raise their lower batteries, and to increase their length, so as to render it equal to four times their breadth. But as his views did not meet with the encouragement which he expected from the government, he constructed a ship at his own expense, and made a

voyage to India in 1594. It may be remarked, that Sir Robert gave the plan of a vessel which he called a *fregata,* which may have led to the construction of the frigates now so generally known.

Singular as it may appear to us at the present day, ships-of-war at this time did not stow any provisions; they were carried by an attendant vessel called the "victualler," of which one was attached to each large ship. The space in the hold, not taken up by the enormous load of shingle ballast required to counterpoise the heavy top hamper, was used as a cook-room; and so lately as the year 1715 several ships-of-war had cook-rooms in their holds.

Passing over another half century, we come to the model of the *Sovereign of the Seas,* or, as called later, the *Royal Sovereign,* of 100 guns, and 1861 tons burthen, built at Woolwich in 1637 by Mr. Phineas Pett. This vessel marks an epoch in the art of ship-building as being the first constructed in England on scientific principles, Mr. Pett being a good mathematician, a graduate of the University of Cambridge.

Another step in improvement was effected by Sir Antony Deane, in 1665, who built the *Warspite* and *Defiance,* to carry six months' provisions, and their lower-deck guns to be 4½ feet out of water. He also has the credit of having been the first who calculated a ship's draft before she was launched. The dimensions of the Spanish ship *Princesa,* of 70 guns, which fell into our hands in the year 1740, caused a revision of our establishment in 1745, and the *Royal George,* of increased dimensions, was

launched in 1756; this ship, which upset at Spithead in 1782, was one of the first that had her bottom sheathed with copper. In the same manner, eleven years after she came into our possession, we built, after the *Invincible*, a French 74-gun ship, and thus got some fine ships, but the practice was not persevered in. The *Commerce de Marseille* formed the ground-work for the *Caledonia* of 120 guns, launched at Plymouth in 1808; but the *Canopus*, of 84 guns, taken in 1798, and acknowledged on all hands to be an admirable specimen of naval architecture, was not adopted to be the model for 84-gun ships of the British navy before the year 1821; and even then by the mode of practical carpentry of the hull pursued in our dockyards, and the weight of stores and provisions considered necessary for efficiency, the whole weight of the ship was increased to such an extent, that the displacement caused by it brought the lower-deck midship port of the British 84 full 18 inches nearer the water than that of her French prototype! It is needless to follow the history further; suffice it to say, that all who served in the blockading fleets during the last war were painfully alive to the fact of the comparative inferiority of our ships to those of France and Spain in speed, stability, and readiness in manœuvring. It is true that the skill of our commanders, and the courage of our seamen, eventually succeeded in triumphantly asserting our naval superiority, but much loss of life might have been spared had our ships, in form, been more on a par with those of our opponents.

Let me not be misunderstood. I am far from wishing to speak slightingly of those who have done good service

to their country, or to deny the great merit of many of our practical builders; but there must be some reason for the admitted inferiority above alluded to; and I can only attribute it to the cause that in France and Spain, and other Continental countries, the aid of science has been called in, and some of the greatest mathematicians of the age have turned their attention to the improvements of the shipping of their country. Colbert, the enlightened minister of Louis Quatorze, employed Rénau, who was, we believe, the first French author that wrote on the theory of ships. He was followed by the two Bernouillis, by Père la Hoste, by Bouger, Euler, by the Spaniard Don Jorge Juan, by Romme, de Borda, l'abbé Bossut, the Swedish Chapman, Chauchot, Clairbois, Dupin, and others, whose writings and discussions must have had a powerful effect towards bringing about the improvements introduced into the navies of France and Spain.

What has been done in England to set against such names? The only English treatise on ship-building at that time that can lay any claim to a scientific character was published by Mungo Murray in 1754; and such was the encouragement he received, that he lived and died a working shipwright in Deptford Dockyard. England has not, to this day, one original truly scientific treatise on the subject in her language. Certainly we have some papers and tracts of modern times, as those by Atwood, on the stability of ships, in the *Phil. Trans.* for 1796–8; the translations of Chapman's great work, by Dr. Inman, to which he has added some valuable notes; the experiments made by Col. Beaufoy in 1791, on the resistance

of fluids, chiefly at his own expense, and since his death published by his son, Mr. Henry Beaufoy, in a 4to. vol., and gratuitously distributed; an act of munificence in the cause of science worthy of the disinterested labours of his father. But the most valuable contributions to this science are the papers* written by the gentlemen of the School of Naval Architecture, established in 1811; yet, after a few years suppressed, while almost all those brought up in it were, for a considerable length of time, kept in subordinate situations,—men familiar with the differential calculus kept chipping timber in our dockyards,—and even now, more than forty years from its first establishment, only five out of the forty-two men there educated have risen to any stations of responsibility! Honour, however, to whom honour is due; the good seed they have sown, we trust, has not been lost; the correct principles of naval architecture laid down by them have become known and generally diffused, and though the *élèves* of the school may not reap the reward, the merit is undoubtedly theirs; posterity will do them the justice which the present age has hitherto denied them.

More recent contributions to the science are an admirable treatise by Creuze, in the *Encyclopedia Britannica;* Scott Russell's Experiments on the Wave-line as applied to Shipping; Professor Moseley's papers in the *Phil. Trans.* on Dynamical Stability, &c.; Peake's "Rudimentary Treatise on Ship-building;" and Fincham's "Outlines of Ship-building," and "History of Naval Architecture."

* Published in the "Papers on Naval Architecture," 1826 to 1832. Edited by Messrs. Morgan and Creuze.

These few later works are recent, and are, we trust, a type of better things to come. The fact is undeniable, that in England science *was* (I trust I may not say it *is*) at a discount. It has already been proclaimed within these walls, on far higher authority than mine, that abstract science must be cultivated if we are not to fall in arrear of other nations. However the term may be slighted by some, who from time to time have managed the affairs of this nation, the study of abstract science, and the systematic pursuit of the study, cannot be dispensed with, if we wish to make true progress in a question which involves the considerations of such abstruse subjects as dynamical stability and the oscillations of floating bodies.

We are invited, in the letter to the Society of Arts, conveying His Royal Highness's suggestions for these Lectures, "to state freely and without reserve our opinion upon the probable immediate effect of the Exhibition on the particular subject of each lecture." What may be its effect with respect to naval architecture and naval affairs in general, it would be difficult to predict; but one thing is certain, that the Exhibition has brought into striking relief the want of union between science and practice, the want of more intimate communication beween scientific and practical men, and has shown the mischief likely to arise if the wall of separation be not broken down. Not only is this true in naval architecture, as shown in a former part of this Lecture, but it is equally true as respects the want of elementary instruction of our naval officers. As steam advances, we must give a mathematical instruction to those who are to command steam-

ships, or we shall be left far astern in the race. What is the education now afforded to youngsters entering the navy? A name without the substance. They may by chance pick up some navigation when the other duties of a ship will admit of it; but as to any systematic instruction, it is out of the question; the very nature of the duties on board an active ship forbids it, however desirous the captain may be to forward it; the result is, that when a few years later the boys come, as men, to study steam, it is no uncommon thing to find that they have to begin with decimals and the elements of algebra. How are we to maintain our ground with neighbouring nations where a cadet is kept for the first two or three years after entering the navy strictly at his studies? I do not advocate the re-establishment of the Naval College on shore, but I would earnestly recommend some plan or other, by means of which boys can be educated; why not a naval school on board a line-of-battle ship moored at Spithead, where systematic instruction in mathematics—the groundwork of a knowledge of steam—and practice in the earlier part of seamanship, might be combined? Unless something of this sort be done, I fear, as steam advances, this country will be left more and more in the background.

Having mentioned the name of Dr. Inman, may it be permitted to a former pupil, in the name of his brother sailors, educated at the Naval College, and of the students in naval architecture, to offer a passing tribute of respect and gratitude to their former master and friend? Whatever little knowledge we may have, we all feel that it is

chiefly to the precepts and example of that able mathematician that we are indebted for it. The valuable notes appended to his translation of Chapman's *Architectura Navalis Mercatoria* prove Dr. Inman to be the highest authority on the theory of naval architecture.

One great inconvenience, arising from the absence in this country of the systematic pursuit of the study I have alluded to is, that there is very little recorded knowledge as to the various attempts at improvement which have been made. This may, perhaps, be illustrated by a short example, abridged from Mr. Creuze's treatise before alluded to. Could it have been possible, that there should have been an official receptacle for this traditional or registered knowledge as early as the sixteenth century, the improvements in shipping, resulting from the system of diagonal trussing, introduced by Sir Robert Seppings in 1810, would certainly not have been so long delayed; for its advantages were evidently suspected at that early period. But we will only take a more familiar and trifling instance. The Romans sheathed their vessels with lead, secured on the bottom with *copper* nails, as we know from a vessel of Trajan's weighed out of the lake of Riccia. In modern naval history, the Spaniards, according to Navarrete, first attempted this in 1514. The earliest ships sheathed with metal in England were those fitted out in 1553 to discover a north-east passage to China, or Cathay, under Sir Hugh Willoughby. Lead-sheathing was again tried in 1671 on the *Phœnix*, and between that year and 1692, twenty ships were so sheathed. It

was then discontinued; but in 1768, the *Marlborough's* bottom was covered with lead, which was removed after a two years' trial. There is then a long interval until 1833, when lead sheathing was tried on the bottom of the *Success* in Portsmouth harbour, and in two years dropped off. Now, had these various experiments been on record, with the reasons of their failure, those causes of failure would not, in all probability, have been repeated in each successive experiment; and, certainly, the lead on the bottom of the *Success* would not have been secured with *iron* nails. It is not improbable, also, that centuries ago some method would have been ascertained of advantageously applying that less costly metal, lead, to the bottoms of hulks, and all stationary vessels, and thus many hundred tons of copper might have been saved to the nation, by a lesson first taught by the *copper* nails in the sheathing of a Roman galley.

To return to the Models of the Exhibition.

The general peace, amongst other blessings, happily brought a change in the system of ship-building. The weakness of ships in straining and working had long been a subject of complaint, and great credit is due to the late Sir Robert Seppings for carrying into practice improvements suggested by himself and others as early as 1806 and 1810. The chief of them were the filling in solid between the timbers up to the light-water line; the system of diagonal trussing for the frame; the connecting the beams with the sides, by shelf-pieces and thick waterways (first suggested by General Bentham, to whom the service is indebted for many useful improvements, both in

our ships and in our dockyards); and, though last not least, the circular stern, of equal strength with every other part of the ship, leaving no point indefensible.

It may be hoped, that we shall not lose sight of the object of the circular stern, and permit utility to be sacrificed to symmetry or to luxury; let us beware of our raking sterns and stern galleries, beauty of form is not an absolute essential to a ship-of-war, the power of depressing the stern guns, and of throwing the fire well clear of the ship, is an object of far more importance.

In 1832, Sir William Symonds succeeded to the office of surveyor of the Navy; and numerous models in the Exhibition, many of which are now on the table, show the difference of form of his ships to those of the old construction; among others may be mentioned the *Queen*, of 116 guns; *Vanguard*, 80; *Vernon*, 50; *Arethusa*, 50; *Pique*, 40; *Spartan*, 26; and *Flying Fish*, 12. Sir W. Symonds is the first constructor of the British navy who has been left unrestricted as to dimensions, and he has consequently been able to introduce into the service ships which undoubtedly bear a high character in some decided points of efficiency as men-of-war. He has also practically demonstrated the possibility of ships-of-war obtaining sufficient stability without the aid of ballast, which is an important advantage, and one which will be yet productive of essential benefit. These advantages, however, are, in some instances, gained at the expense of uneasiness of motion, which is produced by the form given to the sides of the ships immediately above and below their seats in the water, arising from the stability

of his ships being dependent chiefly on breadth of beam at the load-water section. But that Sir W. Symonds broke through an almost adamantine barrier of prejudice, and thereby conferred an important benefit on the navy, is now, we believe, universally acknowledged.

There were several other beautiful models of the experimental 50-gun frigates, to which my limited space will only allow me to refer, as the *Indefatigable*, by Mr. Wm. Edye; the *Leander*, by Mr. Blake; the *Raleigh*, by Mr. Fincham; the *Nankin*, by Mr. Oliver Lang, jun.; the *San Fiorenzo*, by Messrs. Reid, Chatfield, and Creuze; and the *Eurydice*, 26, by Admiral Elliot, &c. Among others, the sectional models of Mr. Joseph White, of East Cowes, deserve honourable mention, as the *Phaeton*, 50; *Daring*, 12; *Waterwitch*, 10; and the *Fox*, with her old and new bows, showing the peculiarity of this builder's long bow, which has proved itself superior to those constructed on the old plan. There were also six models from a line-of-battle ship to a cutter, intended to illustrate a principle advocated by Mr. White, that all vessels for the same service may be built from one design.

There were also models of sailing merchant-vessels, by Messrs. Wigram and Green, of Blackwall; and Smith, of Newcastle (whose ships in practical construction are equal to those built in the Government dockyards); White, of Cowes; Hall, of Aberdeen; Laing, of Sunderland, &c.; proving that, at length, our merchant builders have been compelled to enter on the career of competition, forced on them by the fast American liners, and which for so long a period our mischievous tonnage laws debarred them

from. While official dimensions issued by authority by men unsuited by education, or rather absence of education, to form any opinion on the subject, cramped the energies of our naval architects, the still-more-to-be-condemned tonnage laws operated as an effectual bar to improvement, in the forms of our mercantile shipping.

These laws were the immediate cause of the defects of English merchant ships, and were a glaring outrage on all true principles in the practice of navigation; they amounted in effect, to quote the words of Mr. Scott Russell, to an Act of Parliament for the compulsory construction of bad ships. The merchant princes of London and Liverpool, with their boundless wealth, proverbial generosity, and persevering enterprise, might surely have attracted the attention of men of science to the improvement of their ships, but to what avail, while fettered by that absurd statute, which has saddled this country with some two million tons of inferior shipping? Need we wonder at the amount of shipwrecks? The startling fact, that about two ships a-day throughout the year is the average number of wrecks registered at Lloyd's is a sad corroboration of the acknowledged truth that the mercantile navy of England has hitherto been the least speedy and the most unsafe that belongs to any civilized nation.

The old laws are now repealed; the effect of them, however, must for some time remain. But is the new law much better? A system of internal measurement as a rule for tonnage is strongly advocated by some of the most able of those who have inquired into the question,

including Mr. G. Moorsom; and, doubtless, there is much to be said in favour of it; yet the difference in the specific gravity of a cargo will show the difficulty of adopting that system: for instance, a West India ship of 470 registered tons carried 695 tons of sugar or coal, or 970 tons of mahogany timber, whereas, had she been laden with wool, she would have stowed only 380 tons of cargo! On the other hand the late Tonnage Commission of Revision, including Mr. Parsons, advocated external measurement; but this also has its difficulties, inasmuch as it is stated that an iron vessel might have an advantage over a fir-built vessel of the same external form and dimensions of 28 per cent. Lieut. Sharpe, R.N., and others, are in favour of the difference of displacement as a measure of tonnage, or the cubic contents of the space between the light and low-water lines measured externally for all vessels. Where so many able men have treated on a subject, it is not for me to offer an opinion upon the right rule. But thus much is certain, that the present system works ill; that there are ample materials before the public for settling the question; and that it ought to be settled, so as to leave the builder free to adopt the best form of vessel, without any further delay.

Notwithstanding the impediments alluded to, we trust that many of the improved models of merchant-vessels and yachts shown in the Exhibition may be hailed as the dawn of a better state of things,—of a fresh starting point in the art of ship-building,—and that the American clippers, the American liners, and the yacht *America*,—which, owing to the absence of prejudice and the aid of science in

construction and seamanship, have hitherto fairly distanced us,—may not be allowed to have the whole course to themselves. Let us acknowledge our defeats when they are real, and trust to British character and energy to make them victories on another occasion.

The mention of the *America* naturally leads us to the beautiful models of yachts belonging to the Thames Yacht Club: one of them, the *Nancy Dawson*, has circumnavigated the globe, and, as we all know, her late owner, Mr. Shedden, R.N., gallantly lent his aid in the search, by Behring's Straits, for Sir John Franklin and our missing countrymen. Six of the yachts are by Harvey, of Ipswich, and all the vessels, I believe, are winners of prizes. I gladly embrace this opportunity of saying how much naval architecture and the naval service generally are indebted to the spirited conduct of our yacht sailors, and especially of the Royal Yacht squadron. Their 92 vessels, of 9400 tons, and manned by 1200 picked seamen, do honour to the country. Nor need their owners be discouraged because a faster vessel has been found. Let them remember that the race was anything but a match; the drawing now lying on the table of the lines of the *America*, in accordance, I believe, with the wave-line principle, shows that the displacement of that vessel to the load-line, or the amount that had to be driven through the water, was not more than two-thirds of that of her opponents in general; while the distance between her timbers was 30 inches, and that of her competitors was barely 10 inches. One was a mere shell built solely for racing, the other constructed for the accommodation of a party on a yacht voyage up the

Mediterranean: in short, a race-horse matched against a well-fed carriage-horse.

STEAM VESSELS.

Probably no part of Class VIII. of the Exhibition will be regarded with more interest than that which illustrates the early, progressive, and present application of the steam-engine to navigation. The honour of having first imagined a vessel to be propelled by steam would seem to belong to Blasco de Garay, a Spaniard; and his plan was tried as early as the year 1543, by order of the Emperor Charles V., at Barcelona, on a vessel of 200 tons, which was propelled at the rate of three miles an hour. This experiment would appear to have fallen into oblivion. In 1736, Jonathan Hulls, in England, patented a plan for propelling with paddle-wheels; in 1789, Symington propelled a vessel on the Forth and Clyde Canal at the rate of nearly seven miles an hour; and again, in 1802, satisfactorily worked a steam-tug on the same canal; but it is to the undaunted perseverance of Robert Fulton, an American, that the honour is due of having carried the measure into practical execution; and in August 1807, he made his first passage from New York to Albany in the *Clermont*, of 20-horse power, at an average speed of five miles an hour. In April 1812, Henry Bell, of Helensburgh, established a steam-vessel in the Clyde, and steamed between that place and Glasgow, also at the rate of five miles an hour.

In 1818, a steam-ship crossed the Atlantic from

Savannah to Liverpool; in 1838, just twenty years later, the *Sirius* and *Great Western* made their first voyage to New York; and now, as it is well known, steam-ships of 2000 tons burden and 500 horse-power are navigating the Pacific and Indian Oceans; and they weekly cross the Atlantic at the average rate of ten miles an hour, whatever be the wind or weather; while American river steamers navigate the Hudson at the rate of twenty, if not twenty-two miles an hour.

As a paddle-wheel war-steamer I would direct attention to the model of the *Terrible*, of 1850 tons, and 800 horse-power, designed by Mr. Oliver Lang, of Woolwich Dockyard, which has proved herself one of the most efficient in the navy. He, too, was the builder of the *Comet*, of 238 tons, and 80 horse-power, in the year 1822, the first steamer built in a Government dockyard.

The most successful effort at producing fast sea-going paddle-wheel steamers has resulted from the free competition permitted for the four mail steamers between Holyhead and Kingston, a distance of 56 nautic or 64½ statute miles, which was accomplished by the *Banshee*, built by Mr. Oliver Lang, Jun., engines by Penn, in 3^h 26^m, or at the rate of 16·32 knots, or 18·8 statute miles an hour; the average time of passage being 4^h 3^m, equal to 13·84 knots, or 16 miles an hour for summer and winter. All the four vessels have earned a very high character. A striking example of the value of free competition, and of the builder and engineer working in concert, and both doing their utmost to maintain their high character.

Screw Steamers.

Taking, however, the best of our paddle-wheel war steamers, and admitting all the improvements that have from time to time been introduced, the fact of the small amount of armament that they carry relatively to the burthen of the vessel and the power of the machinery, forcibly claims attention. Latterly the *Odin, Sidon, Terrible,* and *Retribution,* have been constructed to carry broadside guns, but their wheels and part of their machinery must necessarily remain exposed to shot; this is an inherent defect in principle in paddle-wheel steamers, which no skill of the builder can overcome. We are driven, therefore, to seek some other mode of propulsion. This, happily, has been found in the screw; and, perhaps, in the whole range of experiments connected with the application of steam to ships, there is no point of greater interest than the gradual progress and ultimate triumph of the screw-propeller.

The immense advantage of a submerged propeller over the paddle-wheel, as an auxiliary to sailing-vessels, in point of economy, in protection from shot, and as leaving the broadside of a ship-of-war free for guns, renders any sacrifice of time and expense to accomplish the object in the best manner well worthy of the nation.

Passing over the early history of this application of the screw, we come to the patent taken out by Mr. Francis Smith in May 1836, and that by Captain Erricssen in July following. The former made his first trial in the *Archimedes,* on the 20th September, 1837, which at once established the practicability of this propeller. In 1845, a trial of

the relative merits of the paddle-wheel and screw took place between similar vessels, the *Rattler* and *Alecto*, of 888 tons and 200 horse-power, when, with the two vessels lashed stern to stern, the *Rattler*, screw-propeller, towed the *Alecto* astern at the rate of 2½ knots an hour, in spite of all her efforts to the contrary. These experiments appear to have established a superiority for the screw of 17 per cent. Other vessels have since been built in which the screw is used as an auxiliary; and it is understood that the most recent trials made in the squadron of ships lately stationed at Lisbon, fully confirm all that was expected of these vessels. The *Arrogant*, of 360 horse-power, the first screw-frigate introduced into the navy, built by Mr. Fincham, of Portsmouth Dockyard, has established the principle of efficiency and economy. Other important points remain to be decided by means of carefully conducted experiments, among which may be noted,—1st. On the best form of a screw-steamer, so as to overcome the resistance of the water, and to contribute most effectually to a good result of the screw. 2d. The exact relation of horse-power to tonnage that is requisite. 3d. The relation of the length to the pitch of the screw, which seems to be a point of considerable importance; and, lastly, the area of sail that is most suitable. The models sent to the Exhibition of the *St. Jean d'Acre*, of 100 guns, the *Agamemnon* of 90 guns, and the *Impérieuse*, of 50 guns, besides various others, both naval and mercantile, show the attention that is now directed to this mode of propulsion and the rapid progress it is making.

In the mercantile navy the magnificent ship the *Great Britain*, constructed by the eminent builder, Paterson of Bristol, claims the first place, both as an iron vessel and as a screw-propelled steamer. This noble ship, 317 feet long, with engines of 1200 horse-power, has repeatedly made the voyage across the Atlantic; and now that she has been repaired and strengthened, is again open to start on a similar voyage, in which it may be hoped she may meet with the success that her spirited owners deserve. In a country like England, where iron is so abundant, cheap, and well adapted to various purposes, it was natural to use it instead of wood, and it has been largely substituted for timber in building ships. The advantages of iron vessels, when carefully built, consist, generally, in their durability, strength, capacity for stowage, economy, and salubrity; but iron does not appear to be applicable for ships-of-war.

With respect to economy, it appears that the original cost of paddle-wheel steamers, when fit for sea, is about 5*l*. 9*s*. per ton greater than that of screw steamers, and that their current expenses for the year are about 8*l*. per ton more than those of screw vessels. At the same time the average measure of cargo for screw steamers is three-fourths of a ton for each ton of builders' measure, whilst for paddle-wheel steamers it is less than half a ton, or 33 per cent less than the former. Others state the saving at fully two-thirds the cost of each voyage. The greater economy, therefore, is manifest.

There were no models in the Exhibition, as far as I am aware, of the best mode of drops, or other means of

coaling steamers; yet this is a point of great importance, especially in our war-steamers. At present, the operation for a large steamer is an affair of three or four days; thus one of those beautiful, costly vessels, with all her equipment, is for that period enveloped in a cloud of coal-dust; besides the delay in case of need. Coals in the North of England are "teemed" into collier vessels at the rate of 120 tons an hour, when run down by rail from the coalpit; and at Newport and Cardiff, and the coal ports in South Wales, coals are shipped by steam, or by the use of Armstrong's beautiful hydraulic lift, at the rate of sixty tons an hour. Might not something of the sort be contrived in our Government ports?

I feel that I am travelling out of Class VIII., but I cannot forbear to allude to the exquisite models of marine oscillating engines exhibited by two of our first English makers, Maudslay and Penn; the full-sized screw-propeller marine engines, of 700 horse-power, by James Watt and Co., which exceeded 100 tons in weight; and a smaller pair, of seventy horse-power, by Cockerell, of Liege. The progress of science happily has broken through the old-established rules respecting the speed at which the pistons of condensing steam-engines should move; and it may be hoped that ere long our marine-engines may approximate somewhat to the locomotives. At present the contrast is great, as even with direct-action and tubular boilers we only get a power of about four horses for each ton weight of engine; whereas some of the largest locomotives exceed a power of thirty horses for each ton weight. Of course there are many circumstances to be considered,

but they can hardly justify so great a difference as is found to exist.

In calmly considering the various beautiful models sent to the Exhibition, and especially those of the Experimental Squadrons, the philosophical mind would naturally inquire whether the costly experiments these models indicate have been conducted on scientific principles, and whether any analysis of the numerous reports of the trials which have lately taken place have been made, so that the full measure of truth, which, if properly conducted, they are calculated to elicit, has been obtained.

To both these questions we fear we must reply in the negative. The trials have, in many cases, been loosely made; several vessels and several points in each vessel have been tried together; the builder of the vessel or a qualified naval architect has not been on board to watch and register the several points which he alone could be competent to judge of; nor is there any complete register of the several facts brought out on the trials, such as would be useful to a ship-builder.

Taking, however, the reports that have been made *quantum valeant*, have the facts contained in these reports been compared, analyzed, and submitted to a comprehensive generalization? As far as we are aware, it is not the special duty of any persons, or even of any individual, to undertake such a task. It would naturally fall to the lot of the surveyor's office, but the staff of that office, however competent, is quite inadequate to the work; the daily routine of office business, in attending to the wants of ships

building, repairing, and in commission, is already more than it can grapple with.

The consideration of the models of marine engines, and of their application to the screw-propeller, suggests similar inquiries, and the very great cost of these engines renders the necessity of such comparison and analysis even yet more imperative. Some of the recent trials of the screw-steamers, and especially in the Lisbon squadron, appear to have been conducted with great care, and the results are proportionably valuable. The same may be said of a table printed by the Admiralty, showing the introduction and progressive increase of screw propulsion in her Majesty's navy, which is extremely interesting and instructive. But this table, valuable as it is, and highly creditable as it is to the industry of those who compiled it, only affords the elements of the analysis and comparison that I contend for. What information it may convey to a professional engineer I am no judge of, but to a casual observer it is difficult to reconcile the performance of the several engines as shown by their indicated horse-power. As for "nominal" horse-power, it only serves to mystify, and the sooner the term is exploded the better. The average results of this table show that indicated horse-power is nearly double the nominal; but in the case of the *Fairy* it is fully treble, and it is understood that in the *Banshee*, paddle-wheel steamer, before referred to, and the *Vivid*, the indicated horse-power is about five times, and in the *Onyx*, *Violet*, &c. four times the nominal. The *Llewellyn*, Holyhead packet of 654 tons, and 350 nominal horse-power, and the *Terrible* of 1850 tons, and

800 nominal horse-power, both worked up to the same mark of 1800 as the indicated horse-power! If nominal horse-power means the same in paddle-wheel and screw-steamers (which I believe it does not), why these great differences? The question of cost I do not enter into. The above casual remarks may illustrate the desirableness of a careful register of all experiments and an equally careful analysis and comparison of all results obtained. Surely there cannot be a want of men of talent to undertake this task. But will the country avail itself of this talent?

Classification.

During nearly thirty years the formation of a steam navy has been changing the character of England's defences. The Great Exhibition plainly teaches us that hitherto nearly all has been experimental; we have been in a state of transition. But surely the time has now arrived when it would seem incumbent on our rulers to form a system of classification with reference to particular descriptions of service, having respect to the general dimensions of ships, the proportion of steam power to those dimensions and the amount of armament.

Perhaps never did the value of classification come out into such striking relief as in the Great Exhibition. What a Babel of confusion would not that vast building have been without a happily devised system of classification; but by its aid chaos became order. We are told* that

* See "Inaugural Lecture," by Dr. Whewell, p. 27.

millwrights have classified toothed wheels, and that an eminent engineer would classify screws, wheels, axles, &c. If, then, for such small articles its value is recognised, how much more necessary does classification become when applied to such vast machines as steam-ships and their engines? I am afraid to say what number of different engines we may have among the 200 steamers of which our navy is composed; but, perhaps, to assert that each ship has its own peculiar arrangement would not be far from the truth.

Classification, too, should be extended to our sailing vessels. Would any one not acquainted with our navy credit that, to speak within bounds, there are thirty classes of vessels between a first-rate and a brig? Within the last ten years we have launched six classes of brigs alone. Now each of these thirty classes of vessels requires masts, spars, sails, and stores of all sorts, the consequent waste, and the difficulty of supplying wants on a foreign station, may be imagined. But classification of marine engines and of all their parts seems more imperatively called for, and *at once,* or the complication that a few years will produce is not to be told. Mr. Atherton has strongly urged the importance of this subject; he advises that the respective fleets employed in steam-shipping establishments be constructed on a definite plan of general arrangements, and that the variations of power be regulated by a definite scale of sizes constituting a classification system. It is probable that six or at most eight classes would be ample for the purposes required.

ARMAMENTS.

It might seem "the play of Hamlet, without the part of Hamlet," to speak of ships-of-war without mentioning their armaments, were it not that I consider all warlike weapons would have been better excluded from the Exhibition, which was essentially a peaceful gathering, and specially intended by its royal founder to knit all nations together in the bonds of peace and concord. I may, however, briefly state that, for a long series of years, nay, centuries, we contrived to over-load our ships with more guns than their limited dimensions and crowded quarters would bear. We placed 12, 18, 24, and 32-pounders together in the same ship, risking admirable confusion in handing up cartridge and shot in time of action; and as a crowning measure we armed some of our vessels entirely with carronades; so that an opponent's ship, armed with long guns, and having the advantage of speed, could take up her position and destroy her adversary without receiving a shot in return.

Happily those times are past. Our ships now carry long 32-pounders throughout on all their decks, except a stray 68-pounder, reserved for some special occasion: the gun-carriages are better fitted, and adapted to the stern and chase ports of a ship, so that several guns can be fired in the line of keel. The powder is preserved from damp in wood cases with metallic linings; and the magazines are more commodiously placed. These latter, however, are still susceptible of improvement. The separate passages adopted in the French navy for the con-

veyance of cartridges from the magazines up to the several decks or batteries of a line-of-battle ship, might probably be studied with advantage.

But my space is exhausted; I can only regret that the maritime nations of the Continent did not send to the Exhibition specimens of their naval architecture. The Swedish ship-builders, inheritors of the science and art of the celebrated Chapman, author of the *Architectura Navalis Mercatoria*, would have figured honourably, even in comparison with the most advanced seafaring people. Nor have the French builders of Hâvre, Nantes, Bordeaux, and Marseille, contributed to the Exhibition. From France came only a design of the great iron steamer built for the navigation of the Rhone, the most rapid and dangerous of the French rivers, by Schneider, of Creuzot, who, during the last twelve years, has built eighteen steamers, varying from 80 to 300 horse-power for that traffic.

Nor have I time to do more than mention Sir William Snow Harris's admirable lightning-conductor—an example of the practical use that abstract science may be to our navy and to the cause of humanity—an invention that deservedly received a Council medal. Also the chain cables of Sir Samuel Brown; the anchors by Porter and Rodger; Robertson's excellent Manilla rope; Erricssen's sounding-machine; the Admiralty's admirable steering and azimuth compasses; Dent's excellent steering and portable azimuth compasses; Napier's magnetic course indicator; and the Satellite compass, by St. John of Buffalo, intended to point out and measure, the effect upon the needle of any distributing force or local attrac-

tion,—a plan which, if well worked out, might prove valuable on board iron vessels.

Nor, albeit I may lay myself open to Molière's witty remark, "*Vous êtes orfèvre, Monsieur Josse*," can I deny myself the gratification of referring to the admirable charts of the coast of France published by the *Depôt de la Marine* under the superintendence of that veteran surveyor, M. Beautems Beaupré, which compose the superb atlas *Le Neptune Français*; and to the far more voluminous charts and plans of the Hydrographic Office of the Admiralty, not only of our own coasts, but of nearly every country on the face of the globe, prepared under the direction of our own respected chief, Rear Admiral Sir Francis Beaufort, in which is shown what science can do—when science is allowed to prevail—in furnishing the navigator with a guide that enables him to pursue with confidence his path along the shores or across the trackless ocean.

Fishing-boats.

Fishing-boats, however, must have one word. The value of the fisheries in this country, and the means they afford of supplying the poor with cheap and nutritious food, is too important not to claim notice. Cornwall contributed to the Exhibition a model of her Mevagissey and St. Ive's drift-boats for taking pilchards, with their nets and gear; and Semmens and Co., of Penzance, sent a fine Mount's Bay fishing-boat—a class of boats which have not their superior round the coasts of England. On the

drawing exhibited this evening are the lines of the most approved fishing-boats all round the coast of the United Kingdom, not one of which surpasses the Mount's Bay boat. There were also at the Exhibition models of the Hastings, Deal, and Ramsgate luggers, a Yorkshire coble, and a Peterhead herring-boat, and, though last not least, the model of a fishing-smack of Mr. J. E. Saunders, fitted with an auxiliary screw-propeller, which deservedly obtained a medal; the smack is now fishing successfully on the Dogger Bank, runs her fish to Grimsby in the Humber, and thence by rail to London, where the fish is delivered within twenty-four hours of its being caught in the middle of the North Sea. When we consider that the fishing-boats of the United Kingdom in 1850 amounted to 36,000 boats, manned by 150,000 men and boys, it will be admitted that this class of men deserves some consideration—that all that can be done towards improving the boats, such as giving them moderate speed, easy motion at sea, shelter and comfort for the crew, capacity for carrying a large cargo, and safety in taking the beach, should be done; and that as far as may be their small harbours should be deepened, to enable them to obtain shelter in time of need, and at all states of the tide.

I turn to life-boats—the only point on which I can pretend to a little knowledge—and have to express my extreme regret, that the large subject of Shipping, which is the business of a professed Naval Architect, should have been left to a sailor to treat upon.

LIFE-BOATS.

At the extreme western end of the gallery of that mighty building replete with objects, either the produce of our own country or of foreign lands, which contributed to make up the glorious *ensemble* of the Great Exhibition of the Art and Industry of all Nations, might have been seen by the attentive observer, amongst other kindred specimens, a group of models of boats of a peculiar and unusual form. These boats were models of life-boats. And however rich in the treasures and wonders of art, the Exhibition without them would not have faithfully represented this country, inasmuch as it would have omitted one striking national feature of our land—the efforts made in the cause of humanity.

It will, doubtless, be familiar to all assembled in this hall, that it was to the munificence of his Grace the Duke of Northumberland, President of the National Shipwreck Institution, that we were indebted for that collection. In consequence of the numerous cases of shipwreck, and the accidents that had happened to life-boats around the coasts, and especially the recent lamentable case of the upsetting of the Shields life-boat, whereby twenty of the best pilots out of the Tyne were drowned, his Grace offered a reward for the best model of a life-boat. This offer was liberally responded to by boat-builders and others from all parts of this kingdom, and from France, Holland, Germany, and the United States of America, and the large number of 280 models and plans were sent in. Some fifty of the

best of these formed the Duke's contribution to the Great Exhibition.

A report on these models, accompanied by plans and drawings of the most approved of them, was prepared at the expense of his Grace, and 1300 copies of it gratuitously distributed, not only throughout the length and breadth of our island, but to all the maritime nations of Europe and the United States of America; in addition to which his Grace publicly expressed his intention of placing the best life-boats that can be built, and every means for saving life from shipwreck, on all the exposed points of the coast of Northumberland.

It would ill become me to pronounce an eulogium on such princely generosity in this sacred cause; but I am permitted to quote the words of the distinguished senator, Baron Charles Dupin, Chairman of the Jury of Class VIII., who, after reciting the above facts, sums up the award of the Jury in the following words:—

"These models figure among the most valuable productions in our Great Exhibition, and furnish a splendid example of liberality, in the cause of humanity and practical science, never surpassed, if ever equalled. Such are the motives for which we have judged his Grace the Duke of Northumberland worthy of receiving the Council medal."

Such, then, being the importance attached to these models by the unanimous decision of a Jury composed of distinguished men of all nations, and the object being the

cause of humanity, I propose, as briefly as I possibly can, to lay before you :—

1st. The frightful amount of shipwreck and loss of life that annually takes place around our coasts, showing the necessity for life-boats.

2dly. To pass in review the peculiar features of the principal models sent to the Exhibition, and to offer an opinion on the essential qualities of a good life-boat, as to form, dimensions, material, &c.

3dly. To show the present meagre supply of boats and other means of saving life around the seaboard of the United Kingdom; and

Lastly. To offer some suggestions as to the best means of diminishing the frequency of shipwreck, and of saving the lives of those who unfortunately may be exposed to it.

If there be one subject more than another that might be expected to command the attention and enlist the sympathy of a maritime country like Great Britain, it surely must be the safety and welfare of those of her sons "whose business is in the great waters," and yet how imperfectly informed, how supinely indifferent, is the great bulk of our population as to the causes, the prevention, or the mitigation of the horrors of shipwreck!

From official returns it appears, that in the course of the year 1850 there were 692 vessels, of 127,188 tons burthen, wrecked belonging to the United Kingdom, or nearly two a-day. Of these, only four were steamers. By a reference to the annexed Wreck Chart, for the year 1850 alone, it will be seen that 681 British and foreign vessels

were wrecked on the coasts and within the seas of the British Isles. Of these vessels, 367 were total wrecks, sunk by leaks or collisions, or abandoned; and 304 were stranded and damaged so as to require them to discharge cargo; making a total of 681 wrecks. As nearly as can be ascertained, 780 lives were lost. However large it may appear, this is not any very unusual number, a similar amount is annually lost, leaving a proportionate number of widows and orphans.

It is not an uncommon occurrence for a single gale of wind to strew the coast with wrecks. In three separate gales which occurred in the years 1821, 1824, and 1829, there were lost on the east coast of England, between the Humber and the Tees, 169 vessels. In the single gale of the 31st August and 1st September, 1833, no less than 61 British vessels were lost on the sands in the North Sea and on the east coast of England. In the disastrous gale of the 13th January, 1843, 103 vessels were wrecked on the coasts of the United Kingdom. In the gales of 1846 as many as 39 vessels got ashore in Hartlepool Bay alone. In the month of March 1850, not less than 134 vessels were wrecked on our own coasts. In the gale of the 25th and 26th September last, not less than 117 vessels, and in the whole month 153, were stranded, came into collision, or sunk within the seas and along the shores of the United Kingdom, or more than five a-day; and during the month of January of the present year, 120 vessels more have been added to the number. These instances, many of which happen to have been made public by being laid before Parliament, are only a few out of the number that might be

cited, and even these probably fall short of the real numbers. No complete record of shipwrecks is kept; Lloyd's List, however full, is confessedly imperfect. But the facts quoted are sufficient to prove an appalling amount of loss of life, and the absolute necessity that exists for establishing around our coasts the most perfect means in our power for the preservation of life from shipwreck. Of these means the most important is the life-boat.

The first life-boat used in England was invented by Henry Greathead, boat-builder of South Shields, in 1789, in consequence of the wreck of the *Adventure* on the Herd Sand at the entrance of the Tyne. As the first boat of the sort, the original model of which, on the scale of one inch to a foot, now lies on the table, it may be as well to record her exact dimensions. They are as follows:—Length extreme, 30 feet; length of keel, 20 feet; breadth of beam, 10 feet; depth of waist, 3¼ feet; depth inside to the deck, 2⅛ feet; stem and stern alike, 5¾ feet high; sheer of gunwale, 30 inches; pulls ten oars, double-banked with thole-pins and grummets. Very raking stem and sternpost; depth of main keel, 4 inches; great camber or curvature of keel, with three sliding keels. A cork lining 12 inches thick on each side, fore and aft, from the deck to the thwarts; and a cork fender outside, 16 inches deep, 4 inches wide, and 21 feet long, not reaching to stem or stern within 4½ feet. She would not free herself of water, nor self-right in the event of being upset. This boat was built by subscription at South Shields, and launched in January 1790. The Society of Arts rewarded the inventor

with its Gold Medal and fifty guineas in the year 1802;* and Parliament voted to him 1200*l.* in acknowledgment of the utility of his invention.

From that period, now sixty years ago, to the present time, various modifications of the above boat have been built. Some have introduced air-tight cases instead of cork, some water ballast, &c.; but reserving for the present any remark on them, we come at once to the Northumberland prize-model by James Beeching, of Great Yarmouth, which was sent to the Great Exhibition.

It may be seen from the model of that boat now on the table that, from her form, she would both pull and sail well in all weathers: would have great stability, and be a good sea-boat; she has moderately small internal capacity under the level of the thwarts for holding water, and ample means for freeing herself readily of any water that might be shipped; she is ballasted by means of water admitted into a well or tank at the bottom after she is afloat; and by means of that ballast and raised air-cases at the extremities, she would right herself in the event of being upset. It will thus be seen that this model combines most of the qualities required in a life-boat; and the boat which has since been built after it, and is now stationed at Ramsgate, s said to answer her purpose admirably.

Many others of the models sent to the Exhibition have somewhat similar good features. Hinks, of Appledore, to whom a medal was awarded, has greatly reduced the internal capacity of his boat, which gives him precedence over some otherwise equally good forms. Plenty, of New-

* "Transactions of the Society of Arts," vol. xx. p. 283.

bury, also a medallist, has done the same; he has also shown much skill in the mode of applying cork to the bottom of his boat. Two small boats by this builder, one at Appledore, Devon, and the other at Skegness, in Lincolnshire, have been instrumental in saving 120 lives. Harvey and Son, of Ipswich, contribute a fine sailing-boat, which has the property of ballasting with water. The model of Forrest and Laurie, also, has some good points, and takes a fair stand. Teasdel, of Great Yarmouth, another well-deserved medal, is well known as having built several fine boats stationed at Caistor, Pakefield, and Southwold, on the coasts of Norfolk and Suffolk, which have been the means of saving seventy-two lives. One excellent feature in his boats is the use of air-cases detached from the side, so that they can be examined and repaired at any time. In point of workmanship and finish, Teasdel's models were not surpassed by any sent to the Exhibition.

Costain, of Liverpool, is also entitled to credit for his detached air-cases, in the form of breakers or small barrels, secured to the side; and for his diagonal mode of building. His boat, from its form, would pull and sail fairly, and have good stability; but it has large internal capacity, no means of freeing itself from water that may be shipped, and would not right in the event of being upset. At the same time it must be remarked that there are nine boats (built on this model, we believe) stationed at Liverpool; there are also boats designed by him at Carnarvon, at Anglesea, and Shoreham. The Liverpool life-boats, supported by the Dock Trustees, and under the superintendence of

Lieut. Lord, R.N., have been the means of assisting 269 vessels, and saving 1128 lives during the last eleven years, so that the boats must be fine sea-boats, and, in addition (which has no doubt a great deal to do with it), must be efficiently manned and well managed.

Bromley, of Sheerness, has ingeniously filled in the interior of his boat, from the keelson to the flat, with cork and air quartered alternately, thus reducing his internal capacity by a combination of ballast and buoyancy. Lieutenant Sharpe, R.N., proposes to fill the whole of his boat below the thwarts (excepting spaces for the rowers) with cork, so arranged that he can remove pieces of it to make room for passengers, when required. Hodgson, of Blyth, and Arrowsmith, of Portsmouth, also fit their boats with cork, so distributed as to greatly reduce internal capacity, and yet to leave ample space for passengers. Unquestionably the use of cork is preferable to air-cases as being less subject to injury, and there seems reason to believe that the lightest fishermen's cork is sufficiently light to be used for the greater part under the deck instead of air-cases for reducing the internal capacity, and at the same time heavy enough to act as ballast instead of water.

The late Commodore Lord John Hay, C.B., Superintendent of Her Majesty's Dockyard at Devonport, sent the model of a life-boat, which now lies on the table. It will be seen that this boat would pull moderately well and sail fairly, would free herself from water, would right herself quickly in the event of being upset, but is rather wanting in stability. The boat is of a peculiar mode of practical building, being constructed of narrow planks, pinned

together through the edges, without timbers. It is said to be both durable and economical.

Mr. Turner, Assistant Master Shipwright at Devonport, also submitted the model of a boat which he proposes as a Coast Guard safety-galley. Such a boat would pull fast, would free herself of water, would right herself in the event of being upset, but seems wanting in stability. The former of these are valuable points in a boat to be employed in a service so exposed to bad weather as that of the Coast Guard, and a boat of this description, with sufficient stability, would be of great use in the Revenue service.

The group of life-boats generally, from Shields, the Tyne, Sunderland, and others from Hartlepool and Whitby, may be considered as having for its type a flat-bottomed troop-boat, or steamer's paddle-box boat. The model of Farrow, of South Shields, which gained the first premium in a life-boat model competition at South Shields in 1842, and again at Newcastle in 1850, is perhaps a fair specimen of this class. It has small internal capacity, a moderate proportion of delivering area (although not enough), water ballast in the bottom to be admitted when afloat, raised air-cases in the bow and stern-sheets, clear access to the extremities, ample room for carrying passengers, and she might right herself in the event of being upset, all of which are good qualities. With respect to the form of this class of boats, its advantages, beyond great stability, are not easy to be discovered; if the life-boats were towed out to the site of the wreck by a steam-tug, as at Liverpool (and which, in a port like Shields, abounding with steam-

tugs, might have been expected), it would be easier to understand it; but for a boat that has to pull out of a river, and often against a strong wind and tide, it is difficult to comprehend why such a form as that given to the Yarmouth boat, No. 1, should not be preferred. It must, however, be borne in mind that the boats stationed at North and South Shields have done good service, and been instrumental in saving hundreds of lives.

Lee, of Tweedmouth, Milburn, of Blyth, and Edmond, of Scarborough, have sent life-boats after the model of the north-country coble. The good qualities of the coble on the coasts of Northumberland, Durham, and Yorkshire, when employed as a pilot-boat, or a fishing-boat, and in shallow water, and for landing on, or embarking from, a flat beach in not very stormy weather, are too well known to require remark; but it is doubted whether the form is applicable for the general purposes of a life-boat, either on a flat coast or on any other. The low square stern and want of keel on the after body will not admit of running the boat before the wind when blowing hard; and in proof, it may be stated, that in an accident at Newbiggin, in March 1851, when fourteen lives were lost, some of the cobles went down by the stern, and the very fishermen who invariably use the coble for their own purposes, have expressed a wish to have a life-boat of a whale-boat form.

Another class of boats, offering in form a strong contrast to the Shields boats before-mentioned, require notice, as they seem to be intended by their builders for contending with rapid tides and smoother water, rather than the ordinary heavy open sea to which life-boats

are commonly exposed. Their breadth is about one-fourth their length. The models of Messrs. White, the well-known builders at Cowes; of Tredwen, of Padstow; of Semmens and Thomas, of Penzance; of Lieut. Sharpe, R.N., of Hanwell Park; of Sparke, of Exeter; and of Bromley, of Sheerness, belong to this group. As a rowing-boat in moderate weather, a boat after the model of the Messrs. White would distance most of those sent to the Exhibition; and it is known that in very heavy weather such a boat has been the means of saving life. The boat of Mr. George Palmer, of Nazing Park, Essex, is also of this class. It claims attention as being the model which has hitherto been generally adopted by the National Shipwreck Institution; and several similar boats are placed around the coasts, as at the Isle of Anglesey, and elsewhere.

Among other models was one by Mr. Willem Van Houten, of Rotterdam, President of the South Holland Shipwreck Institution, being that of the life-boat in use in Holland, where six boats are stationed in the neighbourhood of the entrance to Rotterdam. This boat has a flat bottom, to suit it to the nature of the coast; it is said to have been the means of saving many lives. M. Ed. Lahure, of Havre, to whom the Jury awarded a medal, sent a full-sized boat, such as is in use at that port; it is of iron, with a very rising floor. It is said to right itself in the event of being upset, and to have been the means of saving several lives. Francis, of New York, also sent a model of what is termed the "life surf-boat," which has the peculiarity of being made of corrugated galvanised iron. From experiments that have been made on this

boat, it appears unsuitable, under its present form, for the general purposes of a life-boat on any part of the coast of this country. We learn from the printed testimonials which accompany this model, that the Government in the United States have established life-boat stations along the coast of New Jersey at every ten miles apart, at a cost, for the whole, of 2000*l*.

We may here add that there are life-boats in France stationed at Havre, Boulogne, and Calais; in Belgium, at Dunkirk and Ostend; in Holland, at Zieriksee, Brouwershauen, Rockanje, Grave'sande, Ter Heide, and Scheveningen, or three on each side of the entrance of the river leading to Rotterdam, within a distance of twenty miles on either side. There are also, it is said, eleven life-boats stationed on the east coast of Jutland, at the expense of the Danish Government, but we have not been able to ascertain the names of the stations; and some on the coast of Prussia, on the shores of the Baltic. We regret that we are not able, either, to name where these are placed; but we well know that the inhabitants of the Island of Rügen are famed for their hospitality and kindness to shipwrecked sailors, and we believe that there are some ancient humane laws still in force respecting wrecks, which are immediately taken charge of by Government officers, and thus those disgraceful scenes formerly of common occurrence nearer home are entirely prevented.

In several of the models it is proposed to use paddle-wheels, and in some a screw, as a propeller, to be worked by cranks. Bremner, of Wick, places his paddle-wheels within what may be considered a double boat. Remington,

of Warkworth, boldly proposes the use of steam, and Coryton of atmospheric air, as a moving power. The time may come when steam may be so under control as to be made directly applicable to a life-boat (and in the form of a steam-tug it is already of great use, and might be much more used with advantage), but for the present we do not feel that we should be warranted in recommending any other propeller than oars. With respect to manual labour applied to cranks for moving paddles, no proof has yet been adduced that sufficient power or speed can be obtained by means of it; paddle-wheels would fail also in turning the boat quickly, or in a short space.

The group of models representing pontoons, rafts, or catamarans, comprises a numerous body. Russell and Oswald, of Douglas, Isle of Man; Dockar, of Banff; the Hon. and Rev. A. Perceval, of Bookham; Gale of Hull, and others, have shown ingenuity in their models, but they cannot be made applicable to the purposes of a life-boat when required to pull off a lee shore in a gale of wind. Catamarans are much used at Bahia, and at other places on the coast of Brazil, and it is known that they remain at sea in stormy weather; but that is a very different thing from being so much under control as to be enabled to approach a wreck. The real use of a raft is that, at the last extremity, and when all boats are stove, it can be formed out of the spars on board the stranded vessel, and thus afford the crew a means of escape by driving ashore before the wind and sea; and every sailor should make himself familiar with the simple

plans proposed by Captain Bullock, R.N. and others, for readily forming such a raft in time of need.

It is unnecessary to touch further on the peculiar features of the several models sent to the Exhibition, but we must invite your particular attention to a model and drawing of a life-boat, designed by Mr. Peake, assistant master shipwright in Her Majesty's Dockyard at Woolwich, and by permission of the Admiralty, built in that yard, under his superintendence. This boat appears to combine most of the requisite qualities of a life-boat. She has buoyancy, stability, power of self-righting, of freeing herself of water, and capacity for carrying a rescued crew, and there is little doubt but that she will prove an efficient boat.

One concluding remark on this part of the subject we may be allowed to add, namely, the satisfaction that we have derived from witnessing the number of models sent in by men who are earning their daily bread as working shipwrights or boat-builders in the various private and public dockyards in different parts of the kingdom, as it affords additional evidence that many of the working class are thinking men, and it evinces a desire to improve, which is highly creditable to them.

The essential points for a life-boat may be gathered from the few remarks that have been already made in noticing the several boats; but having had the advantage of examining all the different models sent to the Exhibition, it may be useful, in a point of so much importance, to state the conclusions arrived at on the several points of form,

dimensions, material, internal fittings, &c.; and this, I believe, will be in accordance with the suggestions of His Royal Highness that these Lectures should, as far as may be, indicate the path for onward progress rather than refer to special excellencies, or pass in review the varied objects in the Exhibition.

Form.

The form best adapted for the general purposes of a life-boat is that usually given to a whale-boat, that is, both ends alike, but with more breadth of beam; fine lines to enable the boat to pull well, but sufficient fulness forward to give buoyancy for launching through a surf; good cheer of gunwale, say an inch for each foot of length, but rounded off towards the extremes; a long flat floor; sides straight in the fore-and-aft direction; the gunwale strake in the midships to tumble home slightly to protect the thole-pins, and the bow strake to flare out slightly to throw the sea off; as much camber or curvature of keel as can be combined with steady steering, and safe launching from a beach, in order that the boat may be turned quickly to meet a heavy roller when about to break on her broadside.

Dimensions.

In point of length life-boats may be conveniently divided into three classes—from 20 to 25 feet, from 25 to 30 feet, and from 30 to 36 feet; which last may be considered the maximum, and a length rarely required. The smaller-sized boat is handy on those parts of the coast

where it is difficult to find a crew, a difficulty that would be found to extend to a great part of the shores of this kingdom. Such a boat would be easily transported along-shore, easily launched, and readily manned, and, except in some special cases, would generally bring on shore the whole of the crew of a stranded vessel; and as the boat's crew need not consist of more than six men, there would, in case of an accident occurring, be fewer lives perilled. The two boats already alluded to as built by Plenty, one on the coast of Devon, and the other on the coast of Lincolnshire, are respectively 18 and 24-feet boats, and they have saved 120 lives within the last few years.

The medium, or 30-feet boat, to pull ten oars double-banked, is probably the best adapted for the general purposes of a life-boat at all places where a sufficient crew can be readily found to man her. Such boats are in use at Liverpool, Shields, Dundee, and other large ports, where no difficulty is experienced in finding a crew, and on a special occasion, at Liverpool, one is said to have brought on shore 60 persons. At less populous places along the coast a 25-feet boat would be found more easily manageable in point of crew.

The maximum, or 36-feet boat, is adapted for such places as Yarmouth, Lowestoft, Deal, &c., where it is the invariable custom to go off under sail, and where there is never a difficulty in finding beachmen to launch or man the boats, however large. The wrecks at Yarmouth and Deal occur generally on outlying sands, and the boat that happens to be to windward on the coast, according to the direction of the wind, goes off under canvass to the

wreck. Thus, should a wreck occur on the Yarmouth sands in a south-east gale, the Pakefield or Lowestoft boat would push off, while in a north-east gale, the Caistor or Corton boat would put to sea. The boats actually in use at these places are from 40 to 45 feet long; they weigh from four to five tons, and cost from 200*l*. to 250*l*. each. They, therefore, form the exception to the general rule; but they are powerful boats, are admirably manned and handled, and have been the means of saving some 300 lives within the last thirty years.

With respect to breadth of beam, in a rapid tideway, as the Tay, the Humber, the Bristol Channel, the shores of the Isle of Man, the Shannon, &c., a boat somewhat of the galley form, but with ends like a whale-boat, would be more suitable than a wider boat. In these exceptional cases the breadth of beam might be one-fourth the length; but for a life-boat, where the requirements are, roominess for passengers, width to pull double-banked, stability to resist people moving about, and occasionally pressing down on one side in rescuing a man from the water, it should never be less than one-fourth. The Tyne boats have a breadth of fully one-third the length, and some more, but such would not seem to be the best proportions; probably as 1 to 3·8, or 8 feet of beam to a length of 30 feet, would best suit the general purposes of a life-boat.

As to depth, it seems only necessary to observe, that a boat that has to be launched through the surf on a beach should not be too shallow in the waist. The well-known Masulah, or surf-boats, at Madras, have sides 8 feet deep. This height, however, would not suit a boat that has to

pull off a lee-shore against a gale of wind, where the less surface exposed the better. As a general rule, the free-board, or height of gunwale, from the surface of the water, with crew and gear on board, should not be less than from 22 to 24 inches.

The weight suitable to a life-boat does not seem to have received much consideration from our builders, to judge from the difference in existing boats. Those at Holy Island, at Yarmouth, and Southwold, as before mentioned, with their gear, weigh about five tons, whereas many of the models sent to the Exhibition were said to weigh less than half a ton. The mean between these two extremes will be near the truth. For however desirable lightness is for transport along a beach, a certain weight of boat is necessary to resist the force of the waves and to retain momentum, so as not to risk being driven back by the sea; under which consideration 1 cwt. or 1¼ cwt. for each foot of length would be a fair general rule. The weight of gear would vary from 5 cwt. to 15 cwt. according as it comprises oars, masts, sails, anchor, cable, warps, &c.

Whatever be the length of the boat, care should be taken that the space between the thwarts should not be less than from 28 to 30 inches, as in pulling in a seaway it is impracticable always to keep stroke; and if the thwarts are too close, the loom of one man's oar is liable to strike the back of the man abaft him. This is a common complaint in life-boats. The oars should be short to pull double-banked, and of fir, as being lighter, more buoyant, and stiffer than ash, which is too pliant. They should

pull with iron thole-pins having rope grummets secured to them, and the pins should be so placed that the boat may be pulled either way, by the men merely turning round on the thwarts.

Materials.

Hitherto all our boats have been of wood, but the testimonials in favour of metal boats are very strong. Galvanized iron (if that process prevents oxidization and the action of sulphur from coal smoke, which does not yet seem to be established) would be the most economical, and the corrugated form of it would give strength. But if metal boats be adopted, copper might be preferred as more durable and more tractable. The boats in which Lieut. Lynch, of the United States navy, descended the rapids of the river Jordan in 1848, were of copper, and that officer reports most favourably of them. It is said that a copper boat is now supplied to every vessel in the United States revenue service, if not to the navy at large. The first cost of such boats would be heavy, but the material would always be of value. In metal boats it is affirmed that the air-tight cases could be more easily built into the boat (if in any case such were admissible), and kept from leaking. About one-tenth of the whole of the models sent to the Exhibition were of iron. I am far from advocating the adoption of metal boats as life-boats, but I would not object to a fair and full trial of them at any convenient opportunity.

In the construction of wood boats, well-seasoned Scotch larch, from its durability and lightness (its specific gravity

being little more than double that of cork), would be found the best material, but neither Polish nor Italian larch should be trusted to. American white cedar is both light and durable. One advantage in having wood boats is, that we should have the benefit of the skill of the numerous boat-builders around the coasts, whereas the building of metal boats is confined to a few hands; and there is an advantage in having a boat built by an experienced man, who designs and executes his own work.

Of gutta-percha, caoutchouc, kamptulicon, and other similar materials, we have no experience that can be relied on. A gutta-percha boat was taken out to the Arctic regions last spring, but the time of trial was too short for any decisive opinion to be formed on its merits. It is stated that the material shrinks, and it certainly will not bear a continued chafe; nor do we know the effect of heat and cold upon it. It is, however, quite possible that some of these materials may prove useful in the internal fittings of a life-boat. A combination of gutta-percha and cork, by Clarkson, of the Strand, and another, consisting of gutta-percha between two layers of thin wood, by Mr. Forster, R.N., may perhaps be well adapted for air-cases. A notion seems prevalent that gutta-percha is very light, but its specific gravity is little less than that of water, or, in other words, it will hardly float. Jeffery's marine glue may also be found useful in the internal fittings of a boat, in joining cork, &c.

Extra Buoyancy.

Extra buoyancy, or that required beyond what the

materials used in the construction of the boat will afford, is the characteristic feature of a life-boat, and as such its nature, amount, and distribution, deserve the most deliberate consideration. If sufficient buoyancy can be obtained by cork, it is far preferable to air-cases, as not being liable to accident. As before-mentioned, there seems reason to believe that a portion of cork may be used under the flat or floor of the boat, so as to reduce the internal capacity, and enable the boat to free herself of water. The only doubt is as to its weight; but cork varies considerably in weight as well as in price; the commonest description of cork, such as used by fishermen as floats for their in-shore nets, does not exceed 12 lbs. weight per cubic foot, and costs about 12*s.* a cwt.; a heavier sort weighs about 15 lbs. per cubic foot. These might be advantageously disposed in the bottom of a boat, covered with gutta-percha, or a light casing, to keep the water out of it, and the boat might then bid defiance to accidents, as thus armed, even if bilged against a rock, she would float.

With respect to air: the great difficulty of rendering vessels permanently air or water-tight, makes them unfit for general use, unless great care and watchfulness be exercised. In those instances in which the air-cases are built into and form part of the boats, it seems doubtful whether any of them can be depended upon for a year; and from various inquiries that have been instituted, there is reason to believe that there does not exist at this moment a complete air or water-tight case (undetached) in any life-boat that has been six months in use around the coasts

of Great Britain. As to air-cases that are detached, they may be better; but unless in the form of small casks, as in the Liverpool boats, there seems sufficient reason to suspect them all. Metal air-cases offer rather a more reasonable prospect of security; but when a life-boat was laid open in Woolwich Dockyard a few years since, it was found that from corrosion there were several holes half an inch in diameter in the copper tubes, supposed to have been air-tight; in fact copper, like other metals, is liable to corrode, and the more so when placed in conjunction with sea-water. The weight, too, of copper tubes makes them objectionable. It has been the practice of Teasdel, an experienced life-boat builder at Great Yarmouth, to build his detached air-cases of thin boards of willow wood, which is both tough and light, and to cover them with painted canvass, and this we believe to be the best; or a sheet of gutta-percha between two thin boards might be adopted, according to Forster's process.

The amount of extra buoyancy may be much less than it has hitherto been customary to give in a life-boat. The cubical contents of the air-cases of many existing life-boats, and of a great part of the models sent to the Exhibition, measure from 200 to 300 feet, equivalent to the support of from six to nine tons of dead weight. Now, if only intended for buoyancy to balance the extra weight likely to be put into a life-boat, this amount is unnecessary. The Liverpool life-boat, already alluded to as having on one occasion brought on shore sixty persons from a wreck, had not above 60 cubic feet of extra buoyancy; this is too

little, but in a 30-feet boat, provided with ample delivering valves, 100 cubic feet, or the equivalent of three tons, is sufficient extra buoyancy for all general purposes.

The distribution of the extra buoyancy requires great care. As a general rule, it should be placed high in the boat, so as not to affect her stability; but circumstances require this rule to be slightly modified. In order to reduce the internal capacity of the boat that she may rise under the weight of a heavy sea that may fall on board, and to enable the delivering valves to act freely, a certain amount of space should be occupied under the flat or floor of the boat, so as to exclude the water; and the question is, so to fill this space with a material of less specific gravity than water, yet sufficiently heavy to ensure the boat's stability when the flat or flooring is laid at from 10 to 12 inches above the keelson, or about the water-line of intended immersion; thus acting generally as ballast, but on emergency as extra buoyancy. From the various plans adopted, this would seem the most difficult problem to solve in the whole arrangements of a life-boat. In some existing life-boats, and in many of the models sent in, reduction of internal capacity is attempted by placing a tight deck fore and aft at from 16 to 18 inches, and even in some at 24 inches, above the keelson, with only air beneath; the result is, that the weights in the boat raise her centre of gravity, and there is a risk of her upsetting when a sea is shipped. Some of the models thus fitted, on being tested as to their stability, went over directly. Other builders, foreseeing this result, added an iron keel to their boats; while some inserted a well or tank amidships for

water ballast, which, as long as it remains in its place, compensates for the amount of air under the flat, and restores the equilibrium. Others have tried a combination of cork and air, alternately distributed, so as to preserve the requisite stability of the boat. But although conceding full merit to water-ballast, which has the advantage of being taken in only when the boat is afloat, and thus leaving her light for transport alongshore, we are of opinion, as before stated, that a portion of cork is better, and that it may be placed in a water-tight case, or in a gutta-percha covering under the deck, up to about 12 inches in height above the keelson, and combine the properties of ballast generally with extra buoyancy in case of need; if above all a light water-tight deck be placed, the cork will be preserved, and very little water will remain to inconvenience the crew or passengers.

The next point to attend to in the distribution of the extra buoyancy is to place the requisite amount of air-vessels in the head and stern-sheets of the boat, from the floor up to gunwale height, in order to give self-righting power, always taking care to leave access to within three and a half or four feet of the stem and stern-post, to enable a man to stand there and receive people from the wreck, as it commonly occurs that a boat cannot go alongside a stranded vessel, but has to receive the rescued men either over the head or stern of the boat. Air-cases should also be placed along the sides of the boat fore and aft, under the thwarts, not for their value as extra buoyancy, but to diminish the internal capacity, and to keep the water that may be shipped away

from the sides of the boat, and to lead it direct to the delivering tubes. In all cases in which air-cases are used, it is recommended that they be not built into the boat, but be detached, so that they may be examined to test if they are water-tight, there being great reason to fear that such is not the case in general, and air-cases built into the sides are liable to open with the working of the boat, or to be stove in going alongside a wreck, as in a recent instance, and thus a boat would be disabled. They should also have valves inserted in them, as sooner or later they are sure to leak; the valves, too, would enable the cases to be aired, and thus preserve them better. Wells' disc valve is the best we have seen for the purpose.

Internal Capacity for Holding Water.

The more the internal capacity is reduced consistently with leaving space for a rescued crew, the better the life-boat. If practicable, the internal capacity for holding water up to the level of the thwarts of a boat thirty feet long should not exceed three tons. It may be diminished by side air-cases from the thwarts to the floor, or by air-cases under the thwarts. On this latter mode of reducing capacity there is a difference of opinion, some contending that it is an advantage to break up a sea, and prevent the water rushing fore and aft the boat, while others think that it is better to let the sea have a fair range, and that then much of the water that comes in over the bows would go out over the stern. The balance seems rather in favour of filling up under the thwarts; it has the certain advantage of reducing capacity.

Means of Freeing the Boat of Water.

In order to efficiency, every life-boat should be provided with the means of freeing herself rapidly of any water she may ship. This would seem a self-evident proposition; but it appears not to be admitted as such by the designers of many of the models, as in them no provision is made for it beyond a bucket for baling. Not to multiply proofs of the necessity for such an arrangement, it is sufficient to cite, as decisive on the point, the recent instance of the Liverpool life-boat, in October 1850, having been obliged to cut her tow-rope, and bear up for the Mersey, in consequence of having shipped a succession of seas. If a boat has large internal capacity, say from six to seven tons, which is not unusual in the Yarmouth boats, and she ships a heavy sea, or a succession of seas, or if, as is commonly the case, while under storm-sails the crew pull out their plugs, and let the boat fill up to her water-line for ballast, should a sudden squall carry away her masts, how is that weight, in addition to the weight of the boat, to be propelled by twelve oars against a heavy sea? it would be impracticable, and the relief of the wrecked vessel must, in such a case, be abandoned.

By means of sufficient delivering-valves or tubes, led through a platform or flat laid a little above the level of the water-line, there seems no reason why the water when shipped should not be carried off rapidly. The area of the valves or tubes should be not less than one square inch for each cubic foot of capacity; more would be better. A question may arise whether it is better that the boat

should free herself by tubes through the bottom, or by scuppers in the sides as shown in several of the models; the former is the more direct and quickest action, but the tubes are liable to be choked in the possible case of a boat grounding on an outlying sand-bank, or on the bar of a river harbour; it will be better, therefore, to be provided with both to meet such an accident. The tubes and scuppers should be closed by self-acting valves; a modification of an apparatus known as Kingston's valve might answer the purpose, or still better, a valve proposed by Mr. George Wells, of 15 Upper East Smithfield.

Provision for Self-righting.

The power of self-righting is a contested point among the best boat-builders; but they seem hardly to have given the subject full consideration. The accidents that have happened to life-boats have not been carefully investigated, and the necessity for meeting these accidents with a remedy has not forced itself upon their minds. But a remedy is necessary. Recent and sad experience has shown that a life-boat may be upset and may drown the crew from want of being able to right herself. Had the South Shields life-boat that upset in December 1849 possessed the means of self-righting, there is reason to believe that many of the crew might have been saved, whereas twenty of the best pilots out of the Tyne were drowned. This, however, is not the only instance of a boat upsetting and remaining bottom up, as will be seen hereafter; but it is sufficient to prove the absolute necessity of grappling with the difficulty, if difficulty it be, and

of overcoming it. Most life-boats have good sheer of gunwale, and, consequently, raised extremities, in which air-cases should be placed, in order that when the boat is bottom upwards, their buoyancy may co-operate most effectually with the weights in the bottom of the boat (now raised, it may be, considerably out of the water) to restore her to her originally upright position. The higher the centre of gravity of a vessel or boat is above the centre of buoyancy, *cæteris paribus*, the less is her stability; and by the separation of these two centres, a condition of instability will ensue, the effect of which will be, that with the slightest motion the boat will reverse her position, or right herself. To determine the necessary extent of separation of these centres in each case involves careful calculation. The best mode of applying this principle will readily occur to most boat-builders. The objections to the raised air-cases at each end are the wind they hold in pulling off a lee-shore, and the obstacle to approaching the stem and stern of the boat; the latter may be modified, the former must be tolerated for the greater benefit in another respect that arises from their adoption. If air-cases be used in the extremes, a layer of cork on the top will afford great protection to them, and better footing for the crew when necessity requires them to stand or jump on them.

It is a singular fact,—and it serves as an additional proof of the want of some systematic record of discoveries accessible to all persons, which I have already had occasion to remark upon in a former part of this Lecture,—that this property of self-righting, which, when recently pro-

posed as one of the requisites of a good life-boat, was almost treated with derision by some of our best boat-builders, should have been acknowledged and publicly exhibited at Leith by the Rev. James Bremner, of Walls, Orkney, as far back as July 1800. He first proposed in 1792 to enable all ordinary boats to self-right by placing two water-tight casks parallel to each other in the head and stern sheets, and by attaching 3 cwt. of iron to the keel. A boat thus fitted was publicly tried at Leith and repeatedly righted, for which a piece of plate was awarded to Mr. Bremner, and in 1810 the Society of Arts voted him a silver medal and twenty guineas.* Yet in 1850, half a century later, the practicability of making a boat right herself was almost derided!

BALLAST.

If the requisite stability, and righting power, can be obtained without ballast, it is very desirable to avoid the incumbrance it causes, in case of having to transport a boat alongshore. In this respect water-ballast has a great advantage, as it is not taken in until the boat is fairly afloat, and may be discharged directly she again touches the beach on landing. Water-ballast, if used in immediate connexion with so-called water-tight cases, as it always must be, requires very good workmanship in the bulk-heads or partitions of the well, in order that they may not become leaky by straining when at sea, or by shrinking when the boat stands ashore, which she sometimes does for a year together. A doubt may arise, too,

* "Transactions of the Society of Arts," vol. xxviii. p. 135.

whether a boat does not require her ballast as much or more at the moment of launching than at any other time; lightness has its advantages, but in launching through a surf a boat requires a certain weight so as not to be readily thrown aside by a breaking sea. All these circumstances considered, we incline to the opinion that ballast given by cork inside in the bottom of the boat is best adapted to meet the varied contingencies to which a life-boat is subjected.

Although a minor point, it may be as well to add, that a moderate-sized cork fender, say four inches in diameter, should be carried round the sides and both ends of the boat at about six inches under the gunwale; but there is no occasion for the unwieldy fender, occasionally 12 inches deep, that may be seen in some life-boats. Holes in the bilge pieces, to enable a man to lay hold of them, should the boat be upset; timber heads, to make warps fast to at each bow and quarter; long sweep oars for steering at each end; a stout roller in the stem and stern-post to receive the cable; spare oars, one for each two that the boat pulls; life-belts, life-buoys, and life-lines; hand-rockets, heaving-lines, and such minor fittings, are indispensable in every life-boat.

Transporting Carriage.

A necessary adjunct to a life-boat is a carriage for transporting it alongshore, or, when the tide is out, for carrying the boat down to the water, and launching it without risk into the sea. The building a good carriage is a problem not easily solved: among the many models

of carriages sent to the Exhibition, not one exactly fulfils the conditions which appear essential. The carriage should combine lightness with strength, to carry at least 40 cwt. in case of need. The boat should be supported as near the ground as may be, so that it does not risk striking the bottom in going over a rocky beach; the wheels should be of large diameter for facility in moving, with broad tires, to prevent their sinking into the sand. The subject appearing to require much consideration, combined with a practical knowledge of details, an application was made by the National Shipwreck Institution to the Master-General and the Board of Ordnance, which was immediately acceded to, and directions given for a carriage to be built in the Royal Arsenal at Woolwich, where it is now in course of construction, under the superintendence of Colonel Colquhoun, R.A., Director of the Carriage Department of that establishment.

Accidents to Life-Boats.

On several occasions in the course of this Lecture allusions have been made to accidents which have happened to life-boats, as illustrating the necessity of certain qualities in them, and there can be no doubt that one of the most valuable aids towards the improvement of our boats would be a detailed account of all such disasters that from time to time have occurred. The following cases are some that have been gleaned, and they are mentioned without the least intention of imputing blame to any party, but solely with a desire to find a remedy, if possible, for

the causes of the disasters as far as we know them. They are as follows:—

At Hartley, on the coast of Northumberland, five miles north of Tynemouth, in the year 1810, one of Greathead's life-boats, carried overland from Blyth, rescued the crews of several fishing cobles that were prevented landing by a high sea tumbling in suddenly upon the coast, unaccompanied by wind. On returning towards the shore, the boat incautiously got too near the South Bush Rock, when a heavy sea broke on board and split her in halves; the result was, that the whole of the crew, thirty-four in number, were drowned.

At Shields, about the year 1820, Greathead's original life-boat, in taking the crew out of the ship *Grafton*, stranded on Tynemouth Rock Heads under the Spanish battery, struck upon a rock, bilged, and swamped, but she nevertheless remained upright, and brought both crews safely to land. This boat had no air-cases, but was filled with cork inside and out.

At Sandy Cove, Kingstown, Dublin Bay, in December 1822, the life-boat, under charge of Lieutenant Hutchison, R.N., went off to the assistance of the brig *Ellen*, of Liverpool, stranded in a heavy south-east gale. The boat had reached the wreck, and the men were coming down over the stern into her, when she filled; the crew attempted to bale the water out with their hats, when another sea fell on board, washed six men, and all the oars, and everything out of the boat, which drifted ashore among the rocks. On this occasion four men were drowned. The wreck drove higher up the beach on

the following tide, and at low water the crew were rescued.

At Lowestoft, in 1825, the life-boat went off to the sloop *Dorset,* wrecked on the southern part of the Holm Sand, in a south-east gale and spring ebb-tide, which caused a very heavy sea on the sand. In consequence of the crew not raising the plugs of the delivering-valves soon enough, the boat filled with water, became unmanageable, and part of the *Dorset's* crew were drowned. The boat, however, although floating level with the lower part of the gunwale, succeeded in reaching the shore in safety with the remainder of the crew of the sloop.

At Winterton, Norfolk, about the year 1829, the life-boat went off to a stranded vessel, the *Mariner,* and while lying alongside her, the flat or deck of the boat blew up, the boat swamped, and the men saved their lives by taking refuge on board the vessel they went to aid. The life-boat was of the form of a steamer's paddle-box boat; it had what was intended to be an air-tight deck, from twelve to fourteen inches above the keelson, but it was always difficult to keep tight, and in the end, as before stated, was forced up by the water beneath it.

At Appledore, Devon, in December 1833, the life-boat, in going off to the brig *Mary Anne,* of Exeter, stranded on the Northam Burrows, was struck by a heavy sea, and turned end over end, it is believed; two of the crew who had lashed themselves to the thwarts were drowned, a third got his lashings loose enough to keep his head above water in the bottom of the boat, and was taken out alive when the boat drove on shore, bottom up, about an hour

after. On this occasion three men were drowned; the remainder of the crew were taken off the life-boat by another boat. Had this boat had the power of self-righting, there seems no reason why the men should not have been saved.

At Scarborough, in 1836, the life-boat went off through the breakers to the rescue of a vessel; as the boat approached the outside of the broken water, a heavy overlap of the sea caught her and turned her *end over end*, shutting up one of the crew inside, where he remained in safety, getting fresh air through the tubes in the bottom, and was taken out when the boat drifted, bottom up, on the beach. Ten lives were lost. This boat is fitted with an air-case under her flat, contents 140 cubic feet, and with a small well for water-ballast, holding about 16 cubic feet, or half a ton.

At Blyth, Northumberland, in October 1841, the life-boat was pulling off against a strong wind, when a heavy sea struck the boat, caused her to run stern under, and to half fill with water. From want of delivering-valves the boat could not free herself; she became unmanageable, and fell off the wind, when a second sea struck her, and she capsized. On this occasion ten men were drowned. The boat had an air-case about 15 inches deep under her flat or platform.

At Whitby, in October 1841, the life-boat was pulling off in a strong E.N.E. gale and a cross sea, to carry provisions to some fishing-yawls that were in distress for food, when a heavy sea struck the boat at the same time that she was caught by a heavy fresh running out of the

harbour, and she capsized. No lives, we believe, were lost. This boat has an air-case 13 inches deep under her platform.

At Tynemouth Haven, in 1842, the life-boat went off on trial in a very rolling swell from the north-eastward; on returning towards the shore, under sail, a heavy sea topped on her quarter, hove her over on her beam ends, and filled the sail, when she turned bottom up, and thus drove ashore, the crew being taken off by a coble, and all saved.

At Robin Hood's Bay, on the coast of Yorkshire, seven miles south of Whitby, in February 1843, the life-boat went off to the assistance of a stranded vessel, the *Ann*, of London, during a fresh northerly gale. The life-boat had got alongside the wreck, and was taking in the crew, when, it is supposed, four or five men jumped into her at once on one side, when, a heavy sea striking her at the same time, she capsized. Many of the crew got on her bottom, while three remained under, and in this state she was drifted towards the shore on the opposite side of the bay. On seeing the accident from the shore, five gallant fellows launched a coble (fitted with air-cases as a life-boat), and tried to pull off to the rescue; but she had hardly encountered two seas, when she was turned *end over end:* two of her crew were drowned, and she drifted ashore bottom up. On this occasion Lieut. Lingard, R.N., of the Coast-guard service, and eleven men, lost their lives. Three men came on shore safely under the life-boat, and some on her bottom, the others were washed off. Had the life-boat possessed the power of self-righting, there

seems no reason why most, if not all the men, should not have been saved.

At Bude, in Cornwall, about the year 1844, the life-boat was exercising, when she shipped a heavy sea, dipped her quarter, and turned *end over end.* Two men were drowned. This boat is of the form of a steamer's paddle-box boat, with air-cases in her bottom 12½ inches deep amidships, contents 105 cubic feet; the surface of the flat or flooring is about on a level with the water-line. The air-case is divided into five compartments, but at the time of the accident it is said that the after compartment was not tight, and consequently it filled with water.

At Penrhyn du, Carnarvon, in the year 1847, the life-boat went off to the assistance of a vessel in distress; there was a heavy cross sea on, and the boat was upset, or, it is said, turned *end over end:* the crew supported themselves on the bottom of the boat for some time, when they made an effort to right her, when the boat rolled right round and remained on her face. The crew supported themselves until taken off by another boat.

At South Shields, on the 4th December, 1849, the life-boat, manned with twenty-four pilots, went out to the aid of the *Betsy*, of Littlehampton, stranded on the Herd Sand; there was a heavy sea from the eastward, but little wind, and a strong ebb-tide. The boat had reached the wreck, and was lying alongside with her head to the eastward, with a rope fast to the quarter, but the bowfast not secured. The shipwrecked men were about to descend into the life-boat when a heavy knot of sea recoiling from the bow of the vessel, caught the bow of the boat and

turned her up on end, throwing the whole of the crew and the water into the stern sheets. The bowfast not holding, the boat drove in this position, astern of the vessel, when the ebb-tide running rapidly into her stern, the boat completely turned *end over end*, and went on shore bottom up. On this occasion twenty out of twenty-four (or double her proper crew) were drowned under the boat. On seeing the accident two other life-boats immediately dashed off from North and South Shields, saved four of the men, and rescued the crew of the *Betsy*.

The boat to which this sad disaster happened is 34 feet long over all, and nearly 11 feet breadth of beam. It is of the form of a steamer's paddle-box boat, or nearly of the original Greathead form, has 30 inches sheer of gunvale, and 11 inches curvature of keel. It is fitted with an air-case under the flat or deck 15 inches in height, which contains 224 cubic feet of air, with a well for water-ballast in the middle holding 30 cubic feet, or 17 cwt. when full. The surface of the flat or deck is 20 inches above the underside of the keel; and the boat is fitted with flat top air-cases around the sides. The boat had an open well when the accident happened, and when thrown over end the water-ballast would run out into her stern. Had she possessed the power of self-righting, it is fair to suppose some of the men might have been saved.

It is but justice to add, and it is a fact highly honourable to the port, that the life-boats at Shields have been in constant use since Greathead first launched his boat there on the 30th of January, 1790, now sixty years since, and,

with the exception of the above accident, it is stated that no life has ever been lost in them, nor any life been lost from want of them. No record prior to 1841 was kept, but between the years 1841 and 1849 no less than 466 persons have been brought on shore from stranded vessels.

At Liverpool, in October 1850, the life-boat, in going out to the ship *Providence,* in tow of a steam-tug, in a very severe gale and heavy sea, shipped a succession of seas, when there being no means of freeing the boat except baling by buckets, the crew cut the tow-rope, and ran back to the Mersey. This appears to be a very rare occurrence, as in the course of the last eleven years the life-boats at Liverpool have been the means of assisting 269 vessels, and have brought on shore 1128 persons, affording decisive proof of the value of such boats when well manned and properly managed.

At Broadstairs, on the 6th March, 1851, the life-boat gallantly went off to the brig *Mary White,* stranded on the Goodwin, rescued seven of the crew out of ten, but, unfortunately, the boat's gunwale was stove while lying alongside the wreck; and the air-cases, being built into the boat, filled with water on the one side; the life-boat thus became disabled, and was drifting away to sea when it was picked up by a lugger, and brought on shore. These instances are all that have come to my knowledge; but as far as they go they are instructive, as pointing out some evils which it is right to shun, and some defects which require remedies.

Necessity of Training.

But especially do they enforce a point which is of essential importance, namely, the absolute necessity of a well-trained crew, and of sailor-like management of a life-boat. All the best qualities combined in one boat will not compensate for want of seamanship and judgment in the coxswain of the boat, who should be cool, steady, acquainted with the set of the tides, and know whether it is right to approach a wreck end on with his boat under her quarter, or to lay her alongside under the lee, or to drop his anchor to windward and veer down to the wreck, as is the usual practice with the Yarmouth and Deal boats, and for which purpose every life-boat should be provided with a heavy anchor and good cable. It is not any peculiarly good quality in the form of the Yarmouth and Deal luggers that enables them to brave the sea in all weathers, but it is the admirable manner in which they are handled by their hardy crews. And if we are to have an efficient set of life-boats along the coasts of the United Kingdom, it is absolutely necessary that fishermen and sailors should enrol themselves as crews and go out frequently for exercise in heavy weather, so as to become familiarized with the qualities of their boats, and to know exactly what they will do in the hour of need. They need no longer have a misgiving about their safety. That a thoroughly good life-boat can be built no longer admits of a doubt; and any boat-builder who will construct a boat after the lines shown in Plates 1 or 13 of the Northumberland Report, may rest assured that he will turn out a boat that, if properly handled, need not fear to face any weather at sea.

Existing means for saving Life.

In a former part of this Lecture I have shown that 681 wrecks occurred in the year 1850, and that 780 lives were lost on our own shores; we have now to consider the extent of the existing means for saving life. It is comprised in the following meagre statement:—In Scotland, with a seaboard of 1500 miles, there are eight life-boats; at St. Andrews, the Tay, Arbroath, Montrose, Aberdeen, Wick, Ardrossan, and Irvine; some of these boats are in tolerable repair, that at Wick is quite new, others are quite unserviceable. The boats at Aberdeen, Montrose, and St. Andrews, have been the means of saving eighty-three lives. There are Manby's mortars at ten stations, and rockets at eight stations; the latter have been instrumental in saving sixty-eight lives. Orkney and Shetland are without any provision for saving life, and with the exception of Port Logan, in Wigtonshire, where there is a mortar, the whole of the west coast of Scotland from Cape Wrath to Solway Firth (an extent of 900 miles, without including the islands), is in the same state.

In England and Wales, with a seaboard of 2000 miles, there are seventy-five life-boats; of these forty-five are stationed on the east coast. On the shores of Northumberland, from Berwick-on-Tweed to the Tyne, there are seven boats, or one for every eight miles; there are three at Shields; fifteen on the coast of Durham and Yorkshire, or one for every ten miles; in Lincolnshire, four boats, or one for every fifteen miles; on the coasts of Norfolk and

Suffolk, from Cromer to Southwold, there are ten boats, or one for every five miles; a fact highly creditable to the county associations. There are life-boats also at Aldborough, Harwich, Broadstairs, and Ramsgate.

On the south coast, from Dover to the Land's End, a distance of 420 miles, there are eight life-boats, but none at Penzance where most needed. At the Scilly Isles there is one inefficient boat; the same at St. Ives and Bude; and one, a little better, at Padstow. So that from Falmouth round the Land's End by Trevose Head to Hartland Point, an extent of 150 miles of the most exposed coast in England, there is not a really efficient life-boat. In the Bristol Channel the North Devon Association maintains three life-boats in Bideford Bay. There is a new life-boat at Ilfracombe, and one at Burnham. On the south coast of Wales—from Cardiff round to Fishguard, a distance of 200 miles—there are two recently placed life-boats, one at Llanelly, the other at Tenby. There are twelve boats on the west and north coasts of Wales, some in a very defective state; and nine in good order at five stations in the important port of Liverpool, liberally supported by the Dock Trustees, and having permanent boats' crews. These boats, as before mentioned, have brought on shore 1128 persons during the last eleven years, thus proving the value of life-boats when kept in an efficient state and properly managed. In all there are thirty boats, one-half unserviceable, to supply the wants of a seaboard 900 miles in extent, from the Land's End to the Solway, including the ports of Liverpool and Bristol.

In the Isle of Man, which, from its position near the centre of the Irish Sea, and in the midst of a great part of the traffic of Liverpool and Belfast, Glasgow and Dublin, has its shores much exposed to wrecks, there is not a single life-boat. The four boats established here by the exertions of the late Sir William Hillary, Bart.—a name honourably associated with that of Mr. Thomas Wilson, formerly M.P. for the City of London, as founders of the National Shipwreck Institution—have been allowed to fall into decay, and hardly a vestige of them remains.

In Ireland, with an extent of 1400 miles of coast, there are eight life-boats, and they are inefficient. Yet there is no part in the United Kingdom in which wrecks are more frequent than on the coast of Wexford; and when we consider that, in addition to the cross-Channel trade, the whole of the foreign trade to Liverpool, and Glasgow, and Belfast, passes through the Irish Sea, the frequency of wrecks on the east coast of Ireland need not create surprise.

Rockets and Mortars.

From official returns, it appears that many of the Coast-guard stations on the shores of England and Wales are supplied with rockets or mortars, at the expense of Government, and some stations have both. There are seventy-three stations which have rockets, thirty which have mortars, and forty-one which have both mortars and rockets. At first sight this seems a fair proportion, and so it would be if the rockets were efficient; but the returns

go on to say, at twenty-four stations rockets have burst, and at forty-two stations lines have broken. In some instances the rockets were old, in others badly made, and the lines in the same state. Yet even with these drawbacks, rockets and mortars have proved most useful. At twenty-two stations where a record has been kept, not less than 214 lives have been saved by them, besides several crews at Caistor, near Yarmouth, and many lives at eight other stations, where no account has been kept of the number. The veteran Captain Manby may reflect with just gratification in his declining years that the mortar he was instrumental in bringing into use as a means of saving life, has proved very serviceable.

There are twenty-five stations in Ireland at which there are either rockets or mortars; but here, as elsewhere on the coasts, lines have broken and rockets have burst; the rockets, too, might be better distributed. Yet, notwithstanding these minor evils, which may be set right without any great difficulty, the testimony in Ireland as well as in England is decisive as to the value of the rocket in effecting communication with a stranded vessel, and thus saving life from shipwreck.

The merit of the first suggestion for forming a connexion between a stranded vessel and the shore by means of a mortar is unquestionably due to Sergeant John Bell, afterwards Lieut. Bell of the Invalid Artillery, a worthy non-commissioned officer, at the siege of Gibraltar. In August 1791, a public trial of his plan was made at Woolwich, when a shell, loaded to weigh seventy-five

pounds, fired from a mortar on board a boat, carried out 150 yards of a deep-sea lead line, by means of which, Bell, with another man, worked himself on shore on a raft of casks. He also proposed to throw a grapnel fitted to be fired from a common six-pounder gun, for the same purpose; and further recommended that the mortar apparatus should be placed at all ports, as Shields, &c., where vessels are liable to ground near the shore, when a line might be thrown over the ship, and thus be the means of saving life. The Society of Arts awarded fifty guineas for this invention; the account of which was published in 1792, in the tenth volume of their "Transactions,"* and a further description and engraving in 1808;† the grapnel and part of the original apparatus may now be seen in the Repository grounds at Woolwich. But the credit of bringing the mortar into effective use for saving life around our coasts is unquestionably due to Captain Manby, as above stated, and most valuable has it proved to be.

For the first use of the rocket, to effect a communication with a stranded ship, we are indebted to Mr. Henry Trengrouse, of Helston, Cornwall, who having witnessed the disastrous wreck of the *Anson* in 1807, on Looe Bar, Mount's Bay, when one hundred lives were lost, proposed the use of a small rocket, with a line attached, to be fired from the ship to the shore. As far as I am aware, his plan was never brought into use, but the inventor received the gold medal of the Society of Arts, and fifty guineas premium in the year 1820.‡ The great merit

* Page 203. † Vol. xxv. p. 135. ‡ Transactions, vol. xxxviii. p. 168.

of Trengrouse's plan was the firing from the ship to the shore, which undoubtedly is the better mode, if vessels can be induced to carry the necessary apparatus, which hitherto has not been the case. Sir William Congreve, it is understood, proposed a somewhat similar apparatus.

But the merit of bringing into use the rocket to carry a line from the shore to the wreck, undoubtedly belongs to Mr. Dennett, of Newport, Isle of Wight, who, about the year 1825, proposed the adoption of a nine-pounder rocket for this purpose, which has since been successfully used in many parts of the United Kingdom. In 1837, Mr. Carte, of Hull, recommended the use of a twelve-pounder rocket for the same purpose, which is now placed at several stations, particularly on the coast of Yorkshire; he has also a sea-service apparatus for use on board a ship, which is efficient, portable, and economical, yet our ships cannot be induced to carry it. The last proposal for this purpose is that by M. Delvigne of Paris, a model of which was in the Exhibition. His proposal is to ball the line up inside a wooden projectile, and to fire it from a howitzer; on a trial during the past summer in Woolwich Marshes, he succeeded in throwing a line 400 yards, we believe, from a five-inch howitzer, with a charge of eight ounces of powder. It is far from impossible that this plan of projecting a line may be so modified as to be rendered very serviceable.

Fully admitting the good service that both rocket and mortar have rendered in their present state, there can be no doubt that the rocket and line may be greatly improved. The maximum range now attained with Dennett's

9-lbs., or Carte's 12lbs. life-rocket in fine weather is 350 yards, but in stormy weather, such as that in which wrecks usually occur, it seldom reaches 300 yards. On many parts of the coast such a limited flight would not reach a stranded vessel: it seems desirable, therefore, to make every effort to increase the range, whether by an improvement in the rocket, or by substituting a lighter line of Manilla or other hemp; and, considering the importance of the object and its intimate connexion with the life-boat, we may be permitted to express our earnest hope that the experiments on this subject which it is understood have been set on foot, will be continued with as little delay as possible until a favourable result is obtained.

Coast-Guard.

In looking over the list of wrecks, no one can fail to be struck at the prominent position occupied by the officers and men of the Coast-guard service on all such occasions. The records of the National Shipwreck Institution show that about one-third of the medals and rewards granted by that Institution for meritorious services are awarded to the Coast-guard. Independently of their other services, they have proved themselves in cases of wreck to be an invaluable body of men; they are familiar with the use of the mortar and the rocket; are always on the watch; always ready to act; and nothing can be more striking on such occasions than the advantage of a well-trained, organized body acting as one man, over a willing, but undisciplined, assemblage of sailors and fishermen. On any future occasion of shipwreck, we may trust that the Coast-

guard officers and men will display the same energy that has hitherto so honourably distinguished them.

SEA-CORONER SUGGESTED.

An attentive consideration of the Wreck Chart annexed to this Lecture, and a careful examination of the returns of wrecks by the Coast-guard officers, forcibly impress on the mind the painful conviction that the greater part of the casualties that occur are not occasioned by stress of weather, but that they are mainly attributable to causes within control, and to which a remedy might be applied. It would be an easy task to enumerate these several causes, but from the absence of exact information it would be difficult to assign the particular cause to each wreck. It might have been reasonably expected that the depositions before the Receivers of Admiralty Droits would have thrown some light on the subject, but those documents are seldom of any use for ascertaining the real cause of wreck. The master of the stranded vessel is naturally anxious to make out the best case for himself, and usually tells as little as he can help; and the receiver, who nine times out of ten is a landsman, is quite unequal to bring out the facts of the case. Some competent local tribunal, then, is necessary before whom the causes might be investigated on the spot, and there would seem no difficulty in forming such a tribunal; it might be as easily managed as a coroner's inquest; the machinery for the purpose is already organized. The inspecting commander of the Coast-guard of the district, the collector or chief officer of customs, and Lloyd's agents, are to be found nearly everywhere around

the coasts, and they could form a tribunal well acquainted with nautical affairs, and in which all merchants and ship-owners would have confidence; and were such a body, with the assistance of the nearest magistrate, authorized to inquire into and report to the Admiralty or Board of Trade on every case of wreck, there is little doubt but that in a very few years the list of wrecks on our own coasts would be greatly diminished. It is well and right to place life-boats, but a better means of preserving life would be to prevent or diminish shipwrecks.

It is not only loss of life to a fearful extent that occurs in these wrecks, but, although a minor consideration, the loss of property is enormous. In the Parliamentary Report on shipwrecks of the year 1836, the loss of property in British shipping wrecked or foundered at sea, is estimated, on an average of six years, at three millions sterling per annum; we may fairly, therefore, assume, that half that amount is annually lost on our own coasts. The whole of this property, though covered by insurance to certain parties, is not the less absolutely lost to the nation, and its cost paid for by the British public, on whom its loss must ultimately fall. The same Parliamentary Report estimates the annual loss of life by the wreck or foundering of British vessels at sea at 1000 persons in each year, and this loss is also attended with increased pecuniary burthen to the British public, on whom the support of many of the widows and orphans left destitute by such losses eventually devolves. Thus, taking only the financial view of the case, the prevention or diminution of shipwreck would be a great national gain.

Conclusion.

A review of the facts furnished by the Coast-guard Returns affords a cheering encouragement as to the future, inasmuch as the number of lives saved from shipwreck through the instrumentality of life-boats, mortars, and rockets (even in their present imperfect, and, on many parts of the coast, ill-organized state), affords undoubted proof of the value of such means for preserving life. Wherever the boats have been looked after, and the crews well trained, as at Liverpool, Shields, and on the coasts of Norfolk and Suffolk, the most signal success has rewarded their exertions. This fact is most encouraging, and cannot be too strongly insisted upon. It is the most gratifying reward to the several local committees and individuals who have perseveringly done their duty, and gives firm ground of encouragement for the future.

The path, then, is clear and distinct. The first step is to ensure a safe and powerful life-boat, and this we feel confident has been accomplished; the next is to build a sufficient number of such boats, place them where required, organize and train the crews, and provide for their supervision and maintenance. In fact, to do for the rest of the United Kingdom what his Grace the Duke of Northumberland has liberally undertaken to do for his own county, namely, to place a well-built life-boat at each of the most exposed points of the coast, and rockets or mortars at all the intermediate stations.

There need be no misgiving for want of funds—no work of real benevolence in this country, when undertaken

in the right spirit, was ever allowed to languish for lack of means; and it is not to be supposed that the cause of the preservation of life from shipwreck will not find equal support. It is not to be believed that the British public will quietly look on and see a thousand lives annually perish, and not make an effort to save a portion of that number, if satisfied that the means of doing so are within their reach. Past experience declares that the means are within our reach. Nor would the task be difficult: the question has only to be grappled with in earnest, and all obstacles will vanish. There is no doubt of hearty co-operation along the whole of our coasts; all that local committees require is to be well directed, and to be enabled to place entire confidence in those who undertake to guide them.

The success that has attended exertions in one place may fairly be reckoned upon in another. There seems no reason why a very few years should not see a life-boat stationed at each of the exposed points on the most frequented parts of the coasts of the United Kingdom; by means of which—with the blessing of Divine Providence upon the endeavours of those who undertake the work—the best results to the cause of humanity may confidently be anticipated.

March 3, 1852.